# Charts On File

# CHARTS
# ON
# FILE™

## By the Diagram Group

# CHARTS ON FILE ™

# EARTH SCIENCES

# PHYSICAL SCIENCES

# LIFE SCIENCES

# NUMBERS

# HUMANITIES

# HOME ECONOMICS AND HEALTH

## Geological time periods

| era | period | epoch | Millions of years ago |
|---|---|---|---|
| PRECAMBRIAN | | Azoic | 4,600 |
| | | | 3,000 |
| | | Archeozoic | |
| | | | 1,000 |
| | | Proterozoic | |
| | | | 600 |
| PALEOZOIC | | Cambrian | |
| | | | 500 |
| | | Ordovician | |
| | | | 440 |
| | | Silurian | |
| | | | 410 |
| | | Devonian | |
| | | | 360 |
| | | *Carboniferous | |
| | | | 285 |
| | | Permian | |
| | | | 250 |
| MESOZOIC | | Triassic | |
| | | | 215 |
| | | Jurassic | |
| | | | 145 |
| | | Cretaceous | |
| | | | 65 |
| CENOZOIC | Tertiary | Paleocene | |
| | | | 55 |
| | | Eocene | |
| | | | 38 |
| | | Oligocene | |
| | | | 25 |
| | | Miocene | |
| | | | 5 |
| | | Pliocene | |
| | | | 2 |
| | Quaternary | Pleistocene | |
| | | | 0.01 |
| | | Holocene | |

©DIAGRAM

*Equivalents in N. America are Mississippian and Pennsylvanian

# Life-forms

| MILLIONS OF YEARS AGO | ERAS | PERIODS/EPOCHS | | LIFE-FORMS |
|---|---|---|---|---|
| 4,600 | PRECAMBRIAN | Azoic | | |
| 3,000 | | Archeozoic | | |
| 1,000 | | Proterozoic | | |
| 600 | PALEOZOIC | Cambrian | | |
| 500 | | Ordovician | | |
| 440 | | Silurian | | |
| 410 | | Devonian | | |
| 360 | | *Carboniferous | | |
| 285 | | Permian | | |
| 250 | MESOZOIC | Triassic | | |
| 215 | | Jurassic | | |
| 145 | | Cretaceous | | |
| 65 | CENOZOIC | Tertiary | Paleocene | |
| 55 | | | Eocene | |
| 38 | | | Oligocene | |
| 25 | | | Miocene | |
| 5 | | | Pliocene | |
| 2 | | Quaternary | Pleistocene | |
| 0.01 | | | Holocene | |



* Equivalents in N. America are Mississippian and Pennsylvanian

©DIAGRAM

## Mountain-building events

| MILLIONS OF YEARS AGO | ERAS | PERIODS/EPOCHS | | MOUNTAIN-BUILDING EVENTS | LIFE |
|---|---|---|---|---|---|
| 4,600 | PRECAMBRIAN | Azoic | | | |
| 3,000 | | Archeozoic | | Older Laurentians | |
| 1,000 | | Proterozoic | | Younger Laurentians | |
| 600 | PALEOZOIC | Cambrian | | Caledonians | |
| 500 | | Ordovician | | | |
| 440 | | Silurian | | | |
| 410 | | Devonian | | Appalacians | |
| 360 | | *Carboniferous | | | |
| 285 | | Permian | | | |
| 250 | MESOZOIC | Triassic | | Urals | |
| 215 | | Jurassic | | | |
| 145 | | Cretaceous | | Rockies | |
| 65 | CENOZOIC | Tertiary | Paleocene | Himalayas | |
| 55 | | | Eocene | | |
| 38 | | | Oligocene | | |
| 25 | | | Miocene | Alps | |
| 5 | | | Pliocene | | |
| 2 | | Quaternary | Pleistocene | | |
| 0.01 | | | Holocene | | |

© DIAGRAM

* Equivalents in N. America are Mississippian and Pennsylvanian

## Evolution from common ancestors
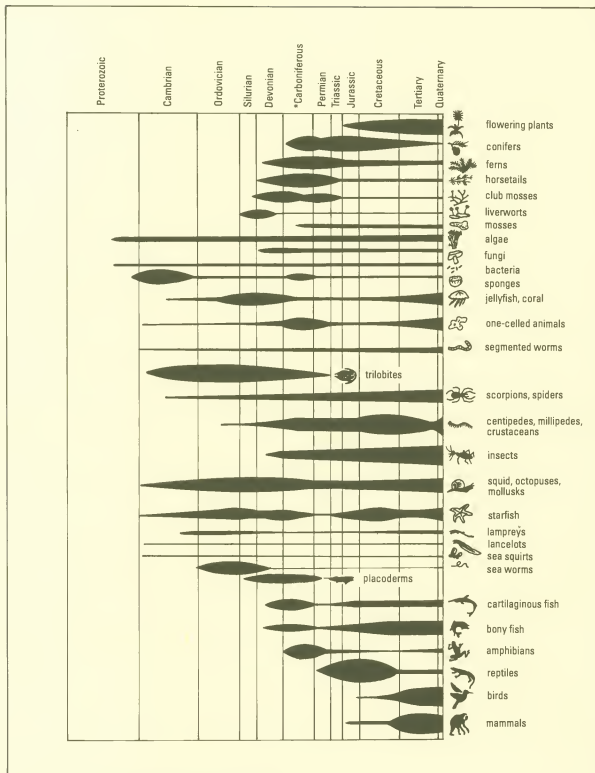
*Equivalents in N. America are Mississipian and Pennsylvanian

## Evolution of organisms

| era | period |
|-----|--------|

* Equivalents in N. America are Mississippian and Pennsylvanian

©DIAGRAM
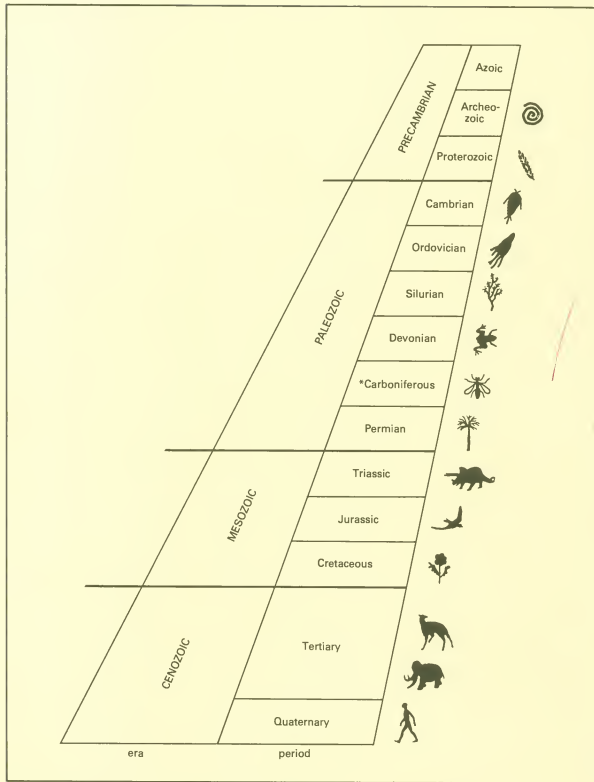
## From ape to man
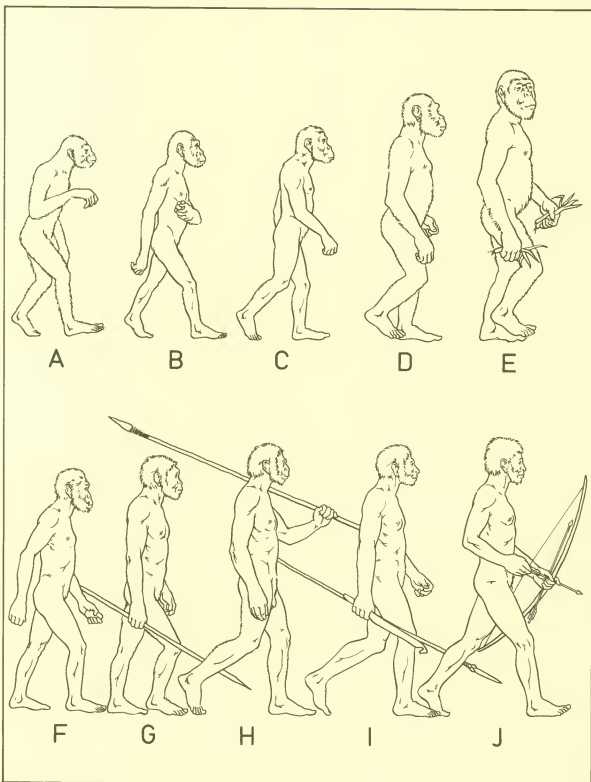
A  Ramapithecus
B  Australopithecus afarensis
C  Australopithecus africanus
D  Australopithecus robustus
E  Australopithecus boisei
F  Homo habilis
G  Homo erectus
H  Homo sapiens (archaic)
 I  Homo sapiens (Neandertal)
J  Homo sapiens (modern)

© DIAGRAM

## Structure of the Earth
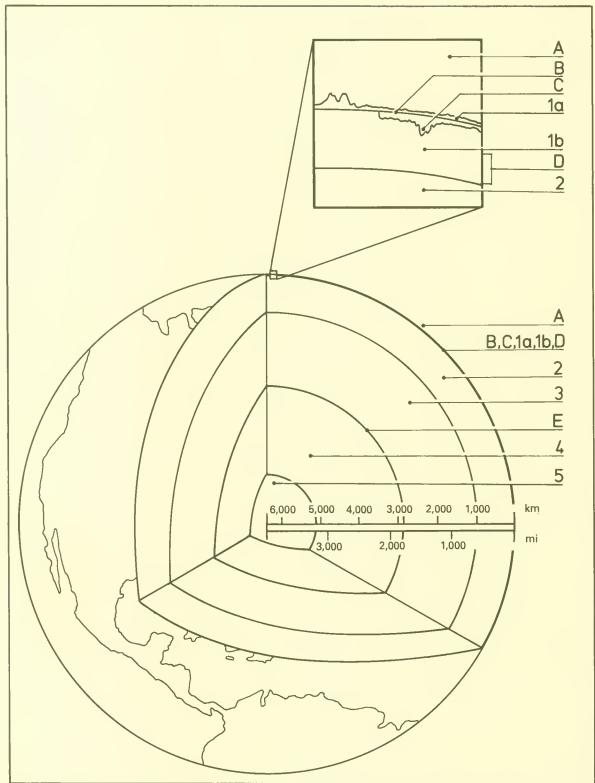
A  Atmosphere
B  Sea level
C  Hydrosphere (oceans)
D  Mohorovicic Discontinuity
E  Gutenburg (Oldham) Discontinuity

1  Crust
a  Sialic continents (silica and aluminum)
b  Basaltic plates (silica and magnesium)
2  Upper mantle
3  Lower mantle
4  Outer core
5  Inner core

© DIAGRAM

## Evolution of the continents

→ Direction of drift of continents

A  180 million years ago
B  135 million years ago
C  65 million years ago
D  Today

a  Gondwanaland
b  Laurasia
c  Tethys Sea
d  Panthalassa
e  Sinus Australis
f  Sinus Borealis

1  Equator
2  80°W
3  20°E
4  140°E
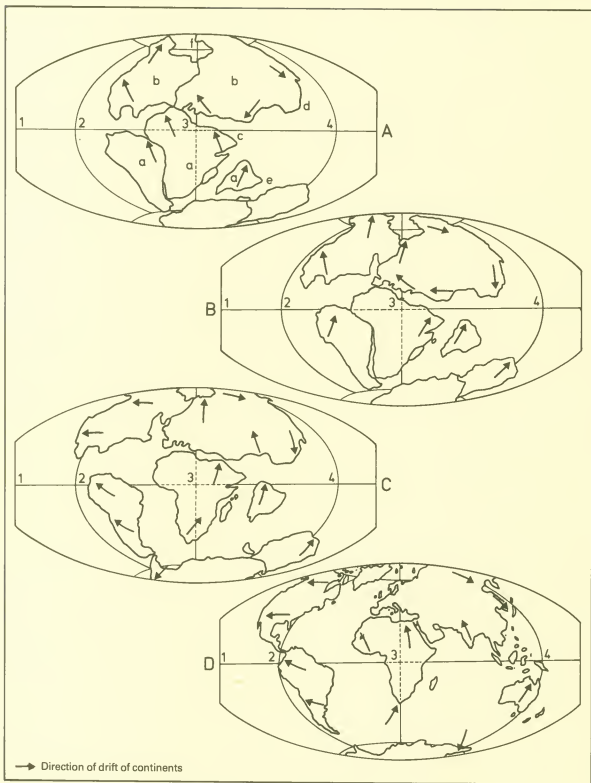
## Comparative size of the continents
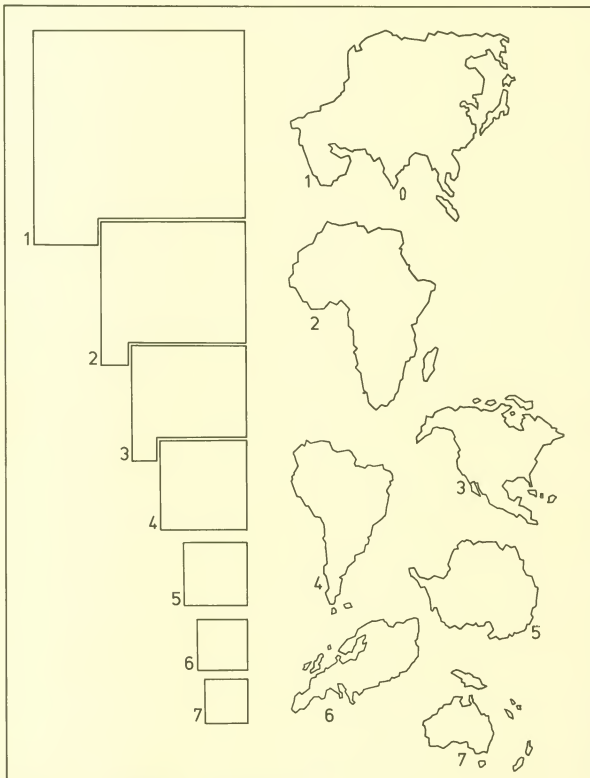
| | | | |
|---|---|---|---|
| 1 | Asia | 17,085,000 mi² | 44,250,000 km² |
| 2 | Africa | 11,685,000 mi² | 30,264,000 km² |
| 3 | North America | 9,420,000 mi² | 24,398,000 km² |
| 4 | South America | 6,870,000 mi² | 17,793,000 km² |
| 5 | Antarctica | 5,100,000 mi² | 13,209,000 km² |
| 6 | Europe | 3,825,000 mi² | 9,907,000 km² |
| 7 | Oceania | 3,295,000 mi² | 8,534,000 km² |

©DIAGRAM

## The World's longest rivers

1 Nile, Africa 4,132 mi (6,650 km)
2 Amazon, S. America 3,900 mi (6,276 km)
3 Mississippi-Missouri-Red Rock, N. America 3,860 mi (6,212 km)
4 Ob-Irtysh, Asia 3,461 mi (5,570 km)
5 Yangtze, Asia 3,430 mi (5,520 km)
6 Huang Ho, Asia 2,903 mi (4,672 km)
7 Zaire (Congo), Africa 2,900 mi (4,667 km)
8 Amur, Asia 2,802 mi (4,509 km)
9 Lena, Asia 2,653 mi (4,270 km)

10 Mackenzie, N. America 2,635 mi (4,241 km)
11 Mekong, Asia 2,600 mi (4,184 km)
12 Niger, Africa 2,590 mi (4,168 km)
13 Yenisey, Asia 2,566 mi (4,130 km)
14 Parana, S. America 2,450 mi (3,943 km)
15 Plata-Paraguay, S. America 2,300 mi (3,701km)
16 Volga, Europe 2,293 mi (3,690 km)
17 Madeira, S. America 2,060 mi (3,315 km)
18 Indus, Asia 1,980 mi (3,186 km)

## The World's highest mountains

The World's tallest inhabited building, the Sears Tower, Chicago, U.S.A., which is 1,454 ft (443 m) high
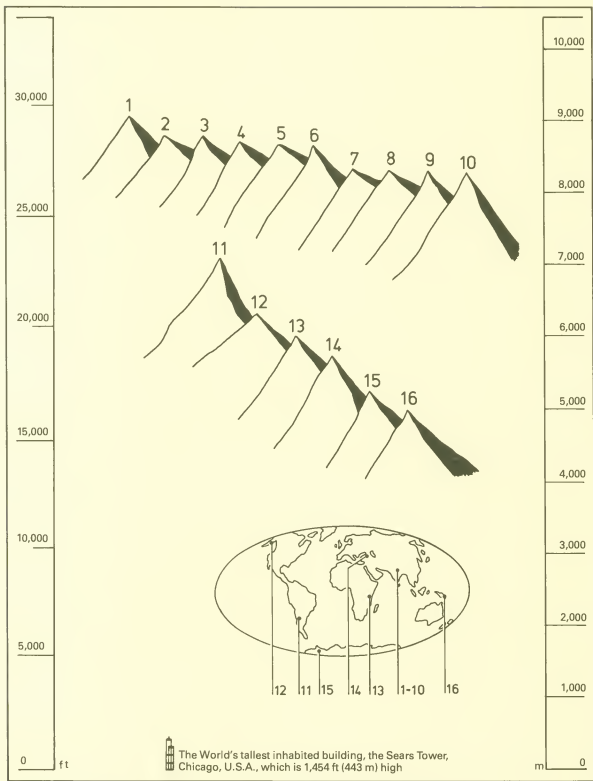
The World's top ten are all in the Himilayas:
1 Everest 29,028 ft (8,848 m)
2 K2 (Godwin Austen) 28,250 ft (8,610 m)
3 Kanchenjunga 28,208 ft (8,598 m)
4 Lhotse 27,923 ft (8,511 m)
5 Yalung Kang 27,894 ft (8,502 m)
6 Makalu 27,824 ft (8,481 m)
7 Dhaulagiri 26,795 ft (8,167 m)
8 Manaslu 26,760 ft (8,156 m)

9 Cho Oyu 26,750 ft (8,153 m)
10 Nanga Parbat 26,660 ft (8,126 m)
The highest by continent:
11 Aconcagua, S. America 22,834 ft (6,960 m)
12 McKinley, N. America 20,320 ft (6,194 m)
13 Kilimanjaro, Africa 19,340 ft (5,895 m)
14 El'brus, Europe 18,481 ft (5,663 m)
15 Vinson Massif, Antarctica 16,863ft (5,140m)
16 Jaya, Oceania 16,023 ft (4,884 m)

©DIAGRAM

## The World's highest waterfalls
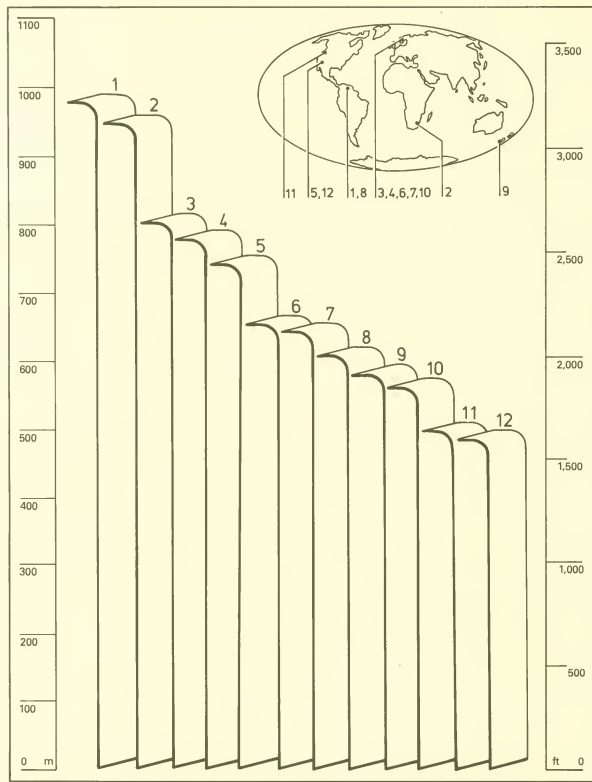
1 Angel, Venezuela 3,212 ft (979 m)
2 Tugela, S. Africa 3,110 ft (948 m)
3 Utigård, Norway 2,625 ft (800 m)
4 Mongefossen, Norway 2,540 ft (774 m)
5 Yosemite, USA 2,425 ft (739 m)
6 Østre Mardøla, Norway 2,154 ft (656 m)

7 Tyssestrengane, Norway 2,120 ft (646 m)
8 Kukenaam, Venezuela 2,000 ft (610 m)
9 Sutherland, New Zealand 1,904 ft (580 m)
10 Kjellfossen, Norway 1,841 ft (561 m)
11 Takkakaw, Canada 1,650 ft (503 m)
12 Ribbon, USA 1,612 ft (491 m)

© DIAGRAM

## The world's largest countries

1 U.S.S.R. 8,649,496 sq. mi.

2 Canada 3,851,790 sq. mi.
3 China 3,705,390 sq. mi.
4 U.S.A. 3,623,420 sq. mi.
5 Brazil 3,286,470 sq. mi.
6 Australia 2,966,200 sq. mi.

7 India 1,266,595 sq. mi.
8 Argentina 1,065,189 sq. mi.
9 Sudan 966,757 sq. mi.

10 Zaire 905,563 sq. mi.

©DIAGRAM
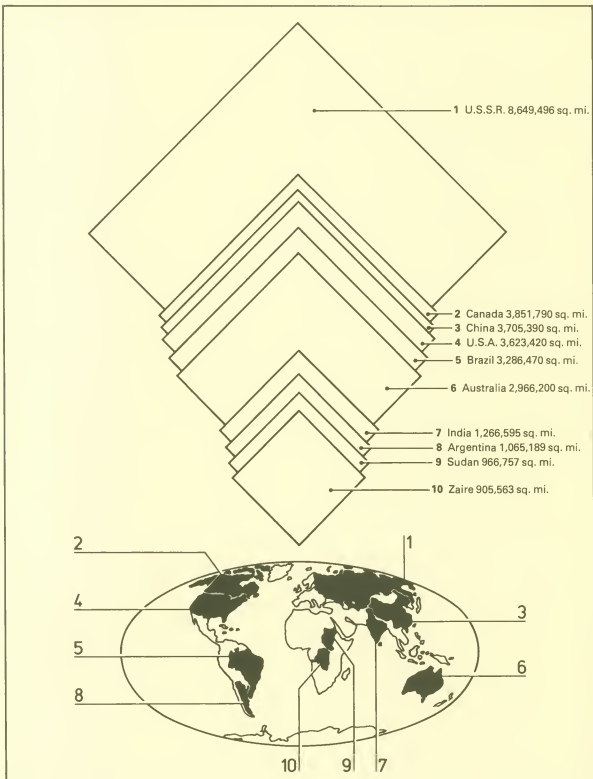
## The world's smallest countries
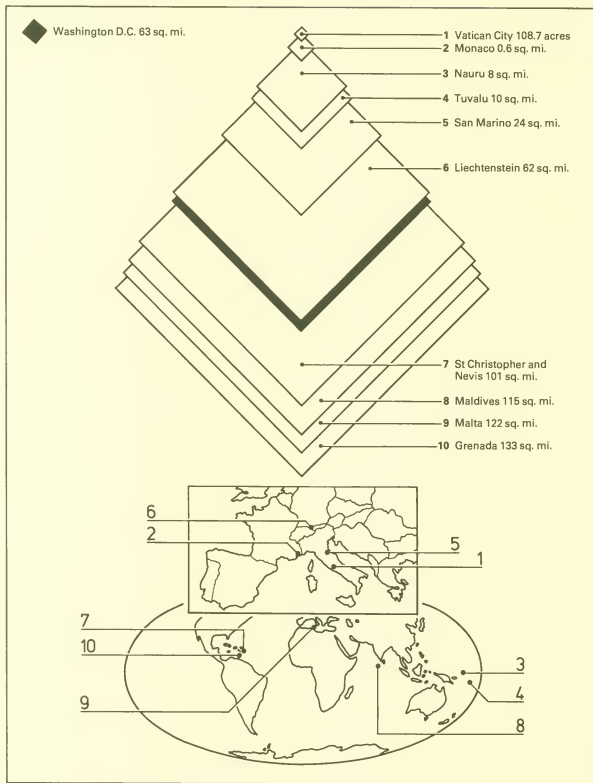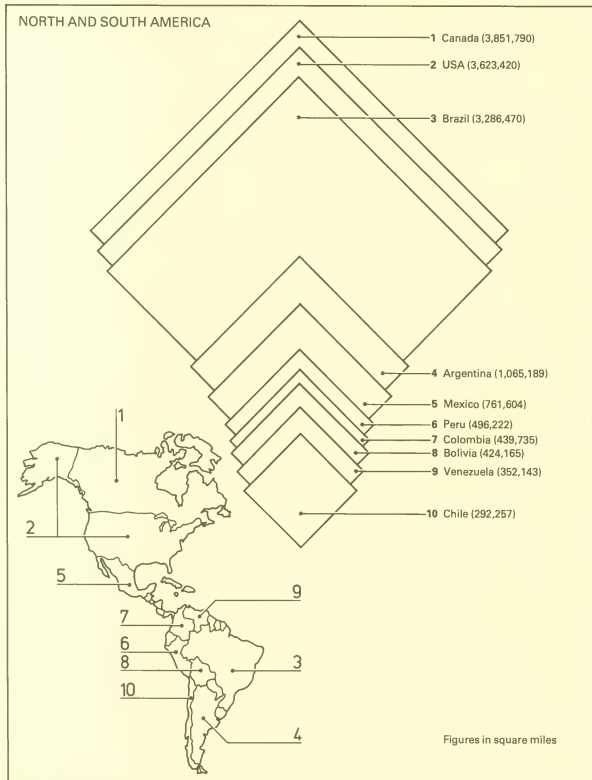
◆ Washington D.C. 63 sq. mi.

1 Vatican City 108.7 acres
2 Monaco 0.6 sq. mi.
3 Nauru 8 sq. mi.
4 Tuvalu 10 sq. mi.
5 San Marino 24 sq. mi.
6 Liechtenstein 62 sq. mi.
7 St Christopher and Nevis 101 sq. mi.
8 Maldives 115 sq. mi.
9 Malta 122 sq. mi.
10 Grenada 133 sq. mi.

©DIAGRAM

## Countries ranked by size and continent: 1

NORTH AND SOUTH AMERICA

1 Canada (3,851,790)

2 USA (3,623,420)

3 Brazil (3,286,470)

4 Argentina (1,065,189)

5 Mexico (761,604)

6 Peru (496,222)

7 Colombia (439,735)

8 Bolivia (424,165)

9 Venezuela (352,143)

10 Chile (292,257)

Figures in square miles

©DIAGRAM

| | | |
|---|---|---|
| Paraguay (157,047) | Panama (29,208) | Dominica (290) |
| Ecuador (109,483) | Costa Rica (19,575) | St Lucia (238) |
| Guyana (83,000) | Dominican Republic (18,816) | Antigua & Barbuda (171) |
| Uruguay (68,037) | Haiti (10,714) | Barbados (166) |
| Suriname (63,037) | Belize (8,867) | St Vincent & Grenadines (150) |
| Nicaragua (50,193) | El Salvador (8,260) | Grenada (133) |
| Cuba (44,218) | The Bahamas (5,380) | St Christopher & Nevis (101) |
| Honduras (43,277) | Jamaica (4,232) | |
| Guatemala (42,042) | Trinidad & Tobago (1,980) | |

## Countries ranked by size and continent: 2

01.016

ASIA AND OCEANIA

1 USSR (8,649,496)

2 China (3,705,390)

3 Australia (2,966,200)

4 India (1,266,595)
5 Saudi Arabia (839,996)
6 Indonesia (735,268)
7 Iran (636,293)
8 Mongolia (604,247)
9 Pakistan (310,403)

10 Burma (261,789)

USA (3,623,420)

Figures in square miles

©DIAGRAM
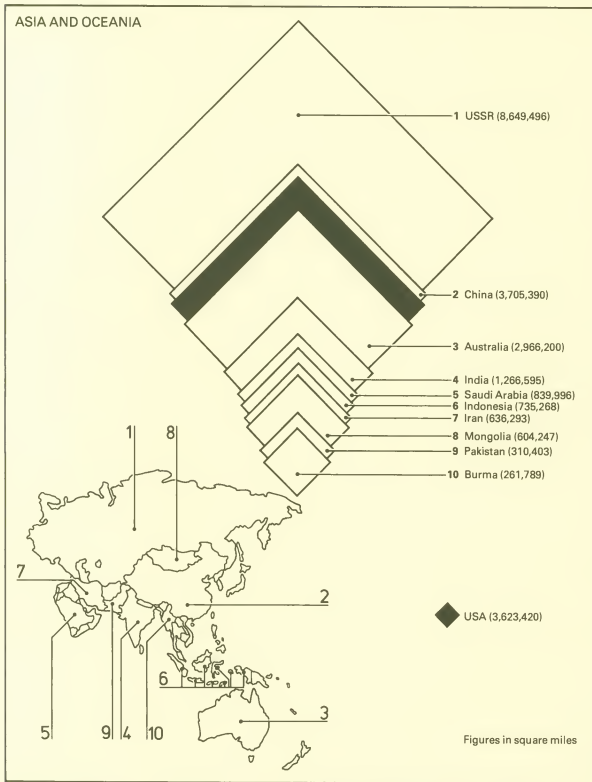
Afghanistan (251,773)
Thailand (198,456)
Papua New Guinea (178,259)
Iraq (167,924)
Japan (145,856)
South Yemen (128,559)
Vietnam (128,401)
Malaysia (127,316)
Philippines (115,831)
New Zealand (103,736)

Laos (91,428)
Oman (82,030)
North Yemen (75,290)
Syria (71,498)
Cambodia (69,898)
Nepal (56,136)
Bangladesh (55,598)
North Korea (46,540)
South Korea (38,025)
Jordan (37,737)

United Arab Emirates (32,000)
Sri Lanka (25,332)
Bhutan (18,147)
Taiwan (13,885)
Solomon Islands (10,640)
Israel (7,847)
Fiji (7,056)
Kuwait (6,880)
Vanuatu (5,700)
Qatar (4,247)

Lebanon (4,015)
Brunei (2,226)
Western Samoa (1,133)
Tonga (270)
Kiribati (266)
Bahrain (258)
Singapore (224)
Maldives (115)
Tuvalu (10)
Nauru (8)

## Countries ranked by size and continent: 3

AFRICA



1 Sudan (966,757)
2 Algeria (918,497)
3 Zaire (905,563)
4 Libya (679,357)
5 Chad (495,755)
6 Niger (489,189)
7 Angola (481,353)
8 Mali (478,764)
9 South Africa (472,359)
10 Ethiopia (471,776)

Alaska (586,412)

Figures in square miles

©DIAGRAM

| | | | |
|---|---|---|---|
| Mauritania (397,954) | Kenya (224,960) | Senegal (75,750) | Rwanda (10,169) |
| Egypt (386,650) | Cameroon (185,568) | Tunisia (63,170) | Djibouti (8,494) |
| Tanzania (364,886) | Morocco (172,413) | Malawi (45,747) | Swaziland (6,704) |
| Nigeria (356,667) | Zimbabwe (150,803) | Benin (43,483) | The Gambia (4,361) |
| Namibia (317,818) | Congo (132,046) | Liberia (38,250) | Cape Verde (1,750) |
| Mozambique (309,494) | Ivory Coast (124,503) | Sierra Leone (27,699) | Comoros (838) |
| Zambia (290,586) | Burkina Faso (105,869) | Guinea-Bissau (13,948) | Mauritius (790) |
| Central African Rep (240,534) | Gabon (103,346) | Togo (21,622) | Sao Tome & Principe (372) |
| Somalia (246,300) | Guinea (94,098) | Lesotho (11,716) | Seychelles (171) |
| Madagascar (226,657) | Uganda (93,354) | Burundi (10,759) | |
| Botswana (231,804) | Ghana (92,098) | Equatorial Guinea (10,832) | |

## Countries ranked by size and continent: 4

EUROPE

1 Turkey (301,381)

2 France (221,207)

3 Spain (194,896)
4 Sweden (173,731)
5 Finland (130,119)
6 Norway (125,181)
7 Poland (120,727)
8 Italy (116,303)
9 Yugoslavia (98,766)

10 West Germany (95,975)

Texas (267,338)

Figures in square miles

© DIAGRAM

UK (94,226)
Romania (91,699)
Greece (51,146)
Czechoslovakia (49,365)
Bulgaria (42,823)
East Germany (41,768)
Iceland (39,769)
Hungary (35,919)
Portugal (35,553)

Austria (32,374)
Ireland (27,137)
Denmark (16,633)
Switzerland (15,941)
Netherlands (15,770)
Belgium (11,779)
Albania (11,100)
Cyprus (3,572)
Luxembourg (998)

Andorra (188)
Malta (122)
Liechtenstein (62)
San Marino (24)
Monaco (0.6)
Vatican City (108.7 acres)

## Atmospheric winds
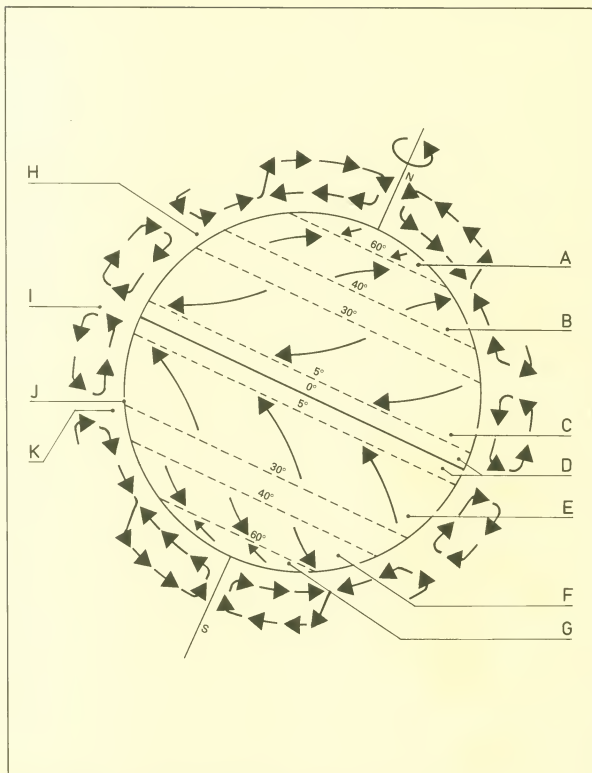
A Polar easterlies
B Prevailing westerlies
C Northeast trades
D Doldrums
E Southeast trades
F Prevailing westerlies
G Polar easterlies

H Belt of descending air
  (high pressure)
I Rising air
J Plane of the ecliptic
K Belt of descending air
  (low pressure)

©DIAGRAM

# The Beaufort scale of wind speeds

| | Beaufort number | Description | Characteristics | Range of wind speed | |
|---|---|---|---|---|---|
| | | | | mi/h | km/h |
| | 1 | Light air | Smoke blown by wind | 1–3 | 1–5 |
| | 2 | Light breeze | Wind felt on face | 4–7 | 6–12 |
| | 3 | Gentle breeze | Wind extends a light flag | 8–12 | 13–20 |
| | 4 | Moderate breeze | Dust and loose paper raised | 13–18 | 21–29 |
| | 5 | Fresh breeze | Small, leafy trees begin to sway | 19–24 | 30–39 |
| | 6 | Strong breeze | Hard to use umbrellas | 25–31 | 40–50 |
| | 7 | Moderate gale | Difficult to walk against wind | 32–38 | 51–61 |
| | 8 | Fresh gale | Twigs broken off tree branches | 39–46 | 62–74 |
| | 9 | Strong gale | Chimneys and roofs damaged | 47–54 | 75–87 |
| | 10 | Whole gale | Uprooting of trees | 55–63 | 88–102 |
| | 11 | Storm | Damage widespread | 64–75 | 103–120 |
| | 12 | Hurricane | Extreme violence | Above 75 | Above 120 |

©DIAGRAM

## How tides work

Forces of gravity
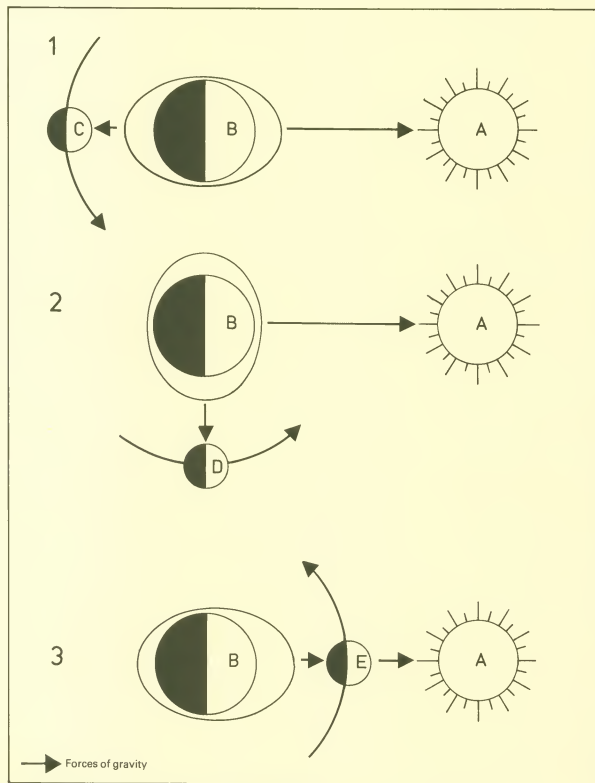
**1** and **3** Spring tides – Sun and Moon are in line with the Earth.
**2** Neap tides – Sun and Moon are at right angles to each other.

A  Sun
B  Earth
C  Full moon
D  First and last quarter moon
E  New moon

©DIAGRAM

## The seasons
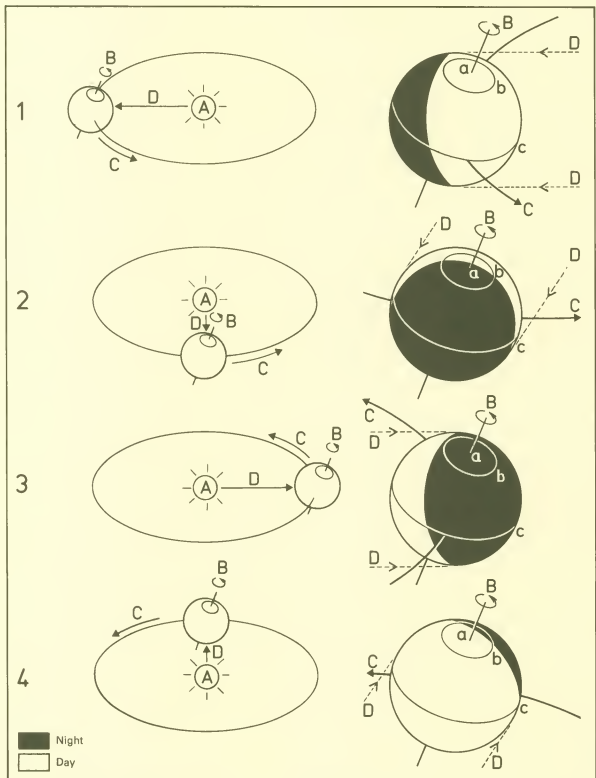
1 Summer solstice – June 21
2 Autumnal equinox – September 23
3 Winter solstice – December 22
4 Vernal equinox – March 21

A Sun
B Rotation of the Earth
C Orbit of the Earth
D Rays of the Sun

a North Pole
b Arctic Circle (66° 30′)
c Equator

Night
Day

©DIAGRAM

## How volcanoes work
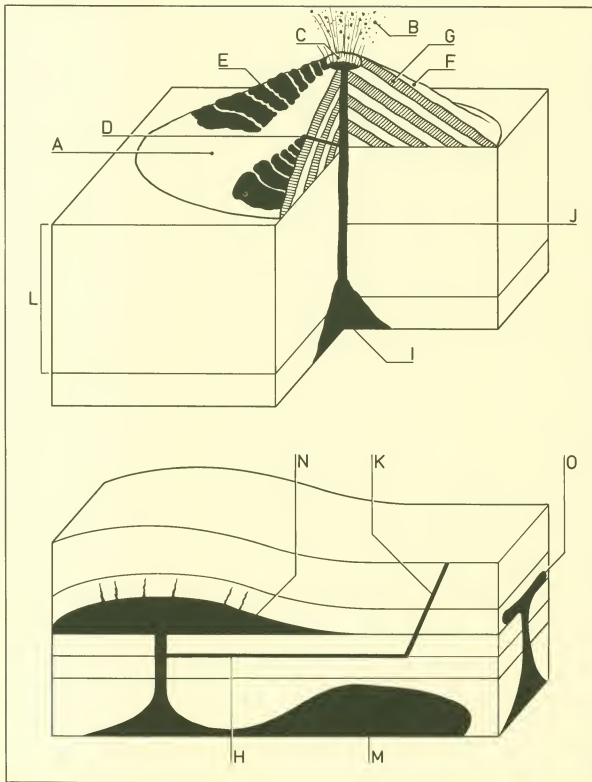
A Volcano
B Molten material and ash
C Crater
D Side vent
E Lava flow
F Ash deposits
G Old lava flow
H Sill
I Magma Chamber
J Conduit
K Dike
L Crustal rocks
M Batholith
N Laccolith
O Lopolith

© DIAGRAM

# How earthquakes happen
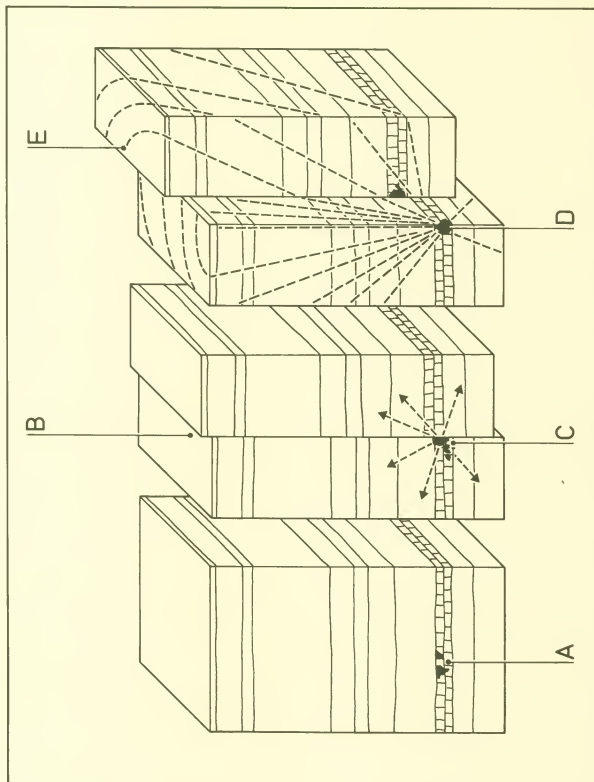
A  Breaking of the Earth's crust under stress
B  Epicenter
C  Shockwaves are generated at hypocenter (focus)
D  Shockwaves travel outwards from hypocenter (focus)
E  Shockwaves reach the surface

©DIAGRAM

# Earthquakes: comparative scales

**C** Mercalli number and characteristics

| | |
|---|---|
| I | Instrumental: detected only by seismographs |
| II | Feeble: noticed only by some people at rest |
| III | Slight: similar to vibrations from a passing truck |
| IV | Moderate: felt generally indoors; parked cars rock |
| V | Rather strong: felt generally; most sleepers wake |
| VI | Strong: trees sway, furniture moves; some damage |
| VII | Very strong: general alarm; walls crack |
| VIII | Destructive: weak structures damaged; walls crack |
| IX | Ruinous: some houses collapse as ground cracks |
| X | Disastrous: many buildings destroyed; rails bend |
| XI | Very disastrous: few buildings survive; landslides |
| XII | Catastrophic: total destruction; ground forms waves |

| **A** Richter | **B** Joules | **D** TNT equivalent |
|---|---|---|
| <3.5 | <1.6 × 10^7 J | <7.6 lb |
| 3.5 | 1.6 × 10^7 J | 7.6 lb |
| 4.2 | 7.5 × 10^8 J | 357 lb |
| 4.5 | 4.0 × 10^9 J | 1905 lb |
| 4.8 | 2.1 × 10^10 J | 5 t |
| 5.4 | 5.7 × 10^11 J | 136 t |
| 6.1 | 2.8 × 10^13 J | 6.6 kt |
| 6.5 | 2.5 × 10^14 J | 60 kt |
| 6.9 | 2.3 × 10^15 J | 550 kt |
| 7.3 | 2.1 × 10^16 J | 5 Mt |
| 8.1 | 1.7 × 10^18 J | 405 Mt |
| >8.1 | >1.7 × 10^18 J | >405 Mt |

| **A** Richter | **B** Joules |
|---|---|
| 0 | 6.3 × 10^-2 J |
| 1 | 1.6 × 10 J |
| 2 | 4.0 × 10^3 J |
| 3 | 1.0 × 10^6 J |
| 4 | 2.5 × 10^8 J |
| 5 | 6.3 × 10^10 J |
| 6 | 1.6 × 10^13 J |
| 7 | 4.0 × 10^15 J |
| 8 | 1.0 × 10^18 J |
| 9 | 2.5 × 10^20 J |
| 10 | 6.3 × 10^22 J |

A The Richter scale which is used to record the magnitude of an earthquake.
B The Joule equivalent of the total energy released.
C The Mercalli scale which measures earthquake intensity.
D The TNT equivalent of the total energy released.

©DIAGRAM

# Mountain formation

A Structural mountains – formed from uplift within the crustal plates of the Earth.
B Fault block mountains – formed from a series of tilted fault blocks.
C Dissected mountains – formed after erosion of plateaus or plains.

## Types of fold

©DIAGRAM
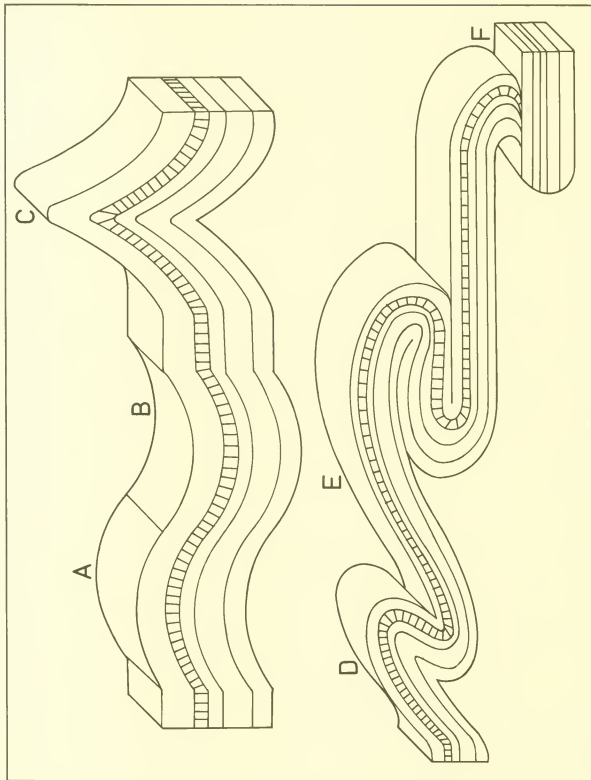
A Anticline
B Syncline
C Tight fold
D Overfold
E Recumbent fold
F Nappe

## Types of fault

Direction of strike
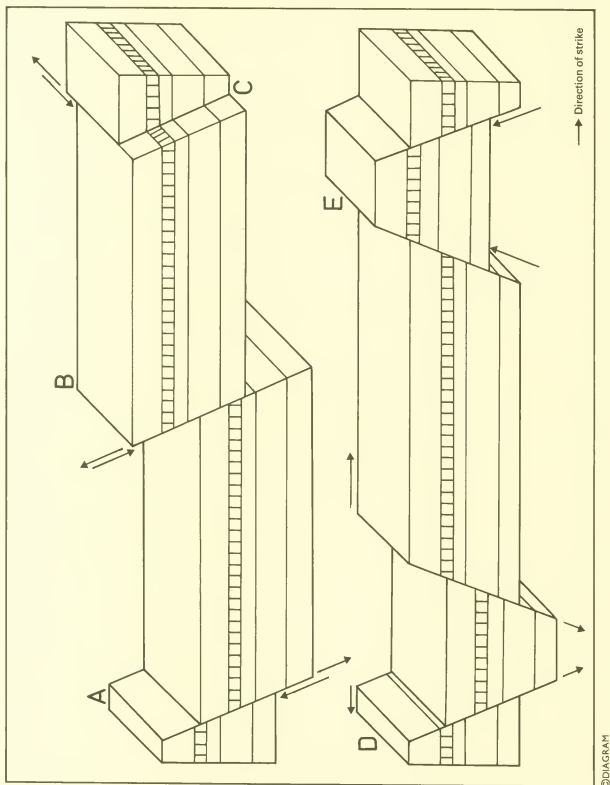
A  Normal fault
B  Reverse (or thrust)
    fault
C  Tear (or strike-slip)
    fault
D  Graben or rift
E  Horst

©DIAGRAM

## Clouds in a depression
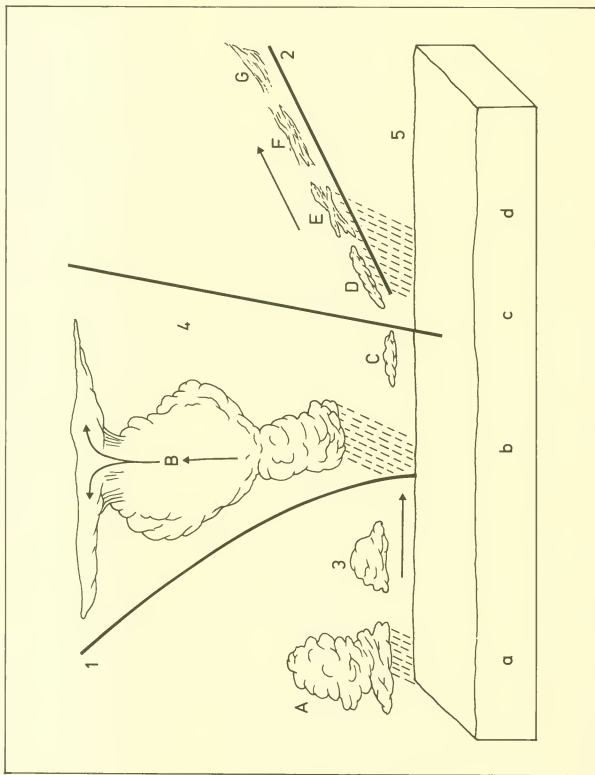
A Cumulus
B Cumulonimbus
C Stratocumulus
D Nimbostratus
E Altostratus
F Cirrostratus
G Cirrus

1 Cold front
2 Warm front
3 Cold air
4 Warm air
5 Cool air

a Scattered showers
b Heavy rain
c Belt of rain
d Drizzle

© DIAGRAM

## Types of cloud

40,000
30,000
20,000
10,000
ft

12,000
9,000
6,000
3,000
m
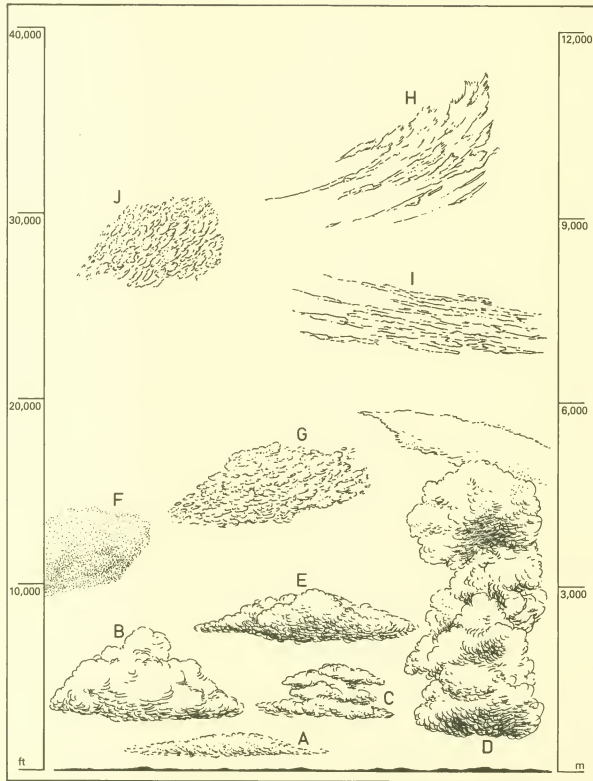
© DIAGRAM

**Low clouds**
A Stratus
B Cumulus
C Stratocumulus
D Cumulonimbus

**Middle Clouds**
E Nimbostratus
F Altostratus
G Altocumulus

**High clouds**
H Cirrus
I Cirrostratus
J Cirrocumulus

## Structure and composition of the atmosphere

1

Altitude in km/mi

Pressure in millibars

A

Mesopause

B

Stratopause

C

Tropopause

D

Temperature in °C

Temperature

2

C,D,E,F,G,H,I

B

A
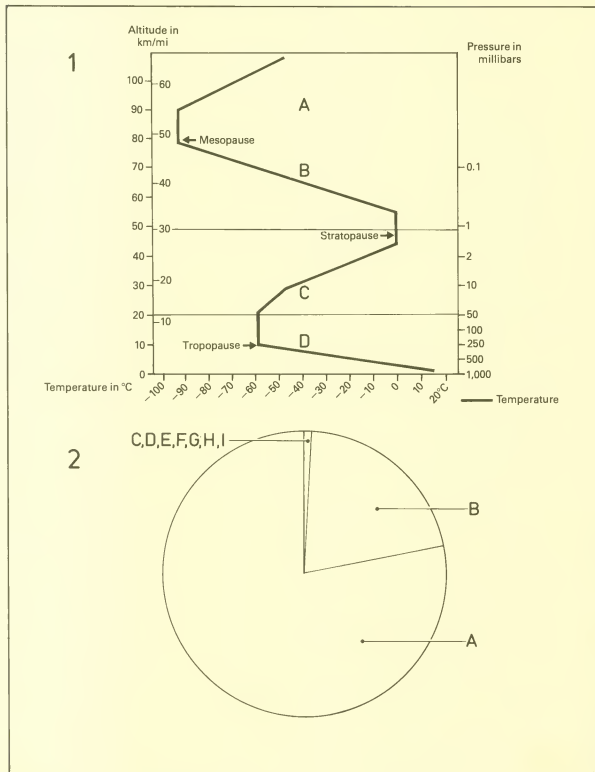
1 Structure
A Thermosphere
B Mesosphere
C Stratosphere
D Troposphere

2 Composition
A Nitrogen (78.02832%)
B Oxygen (20.99%)
C Argon (0.94%)
D Carbon dioxide (0.03%)
E Hydrogen (0.01%)
F Neon (0.00123%)
G Helium (0.0004%)
H Krypton (0.00005%)
I Zenon (0.000006%)

© DIAGRAM

## The hydrological cycle
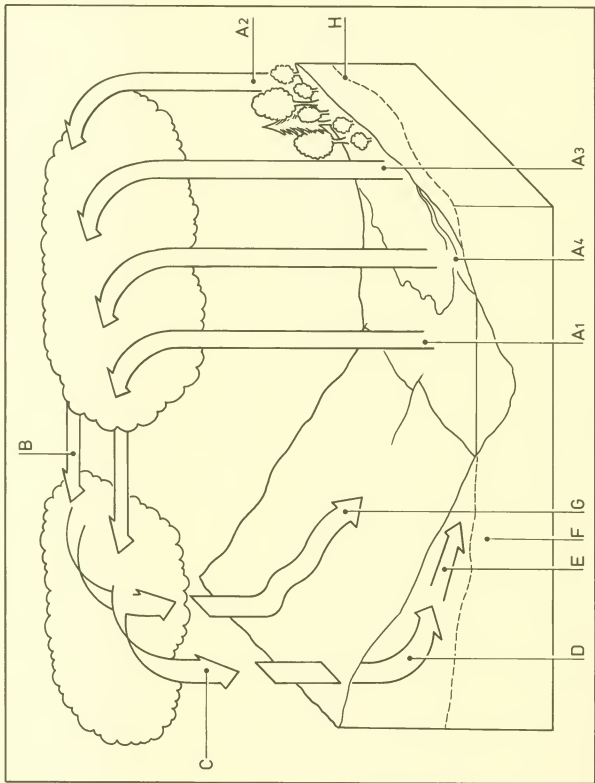
A Evaporation from
1 Lakes
2 Vegetation
3 Soil
4 Streams
B Movement of
moisture
C Precipitation
D Infiltration
E Percolation
F Groundwater flow
G Surface runoff
H Water table

©DIAGRAM

## Tropical rain forest

Height in feet

165
150
120
90
60
30
0

A

B

C

D

Height in meters

50
40
30
20
10
0
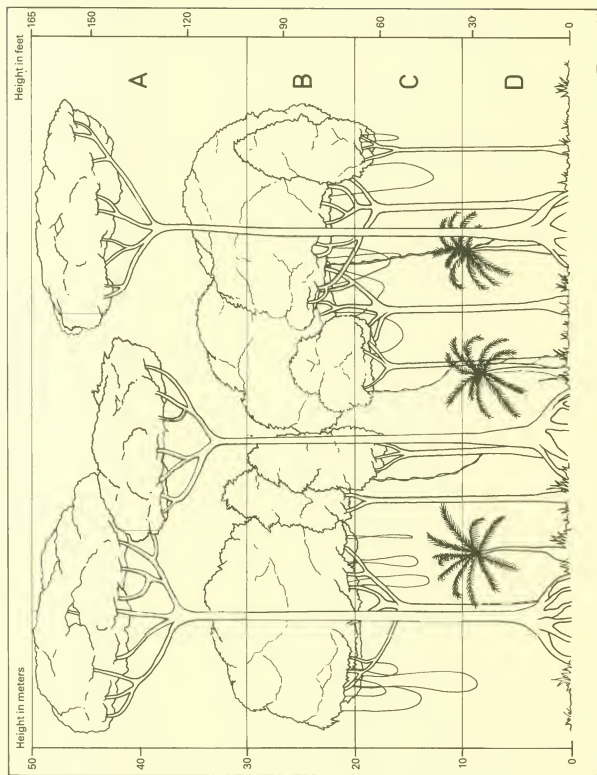
A The emergents
(upper layer)
B The canopy
C The middle layer
D The lower layer

©DIAGRAM

## Soil erosion – causes and solutions
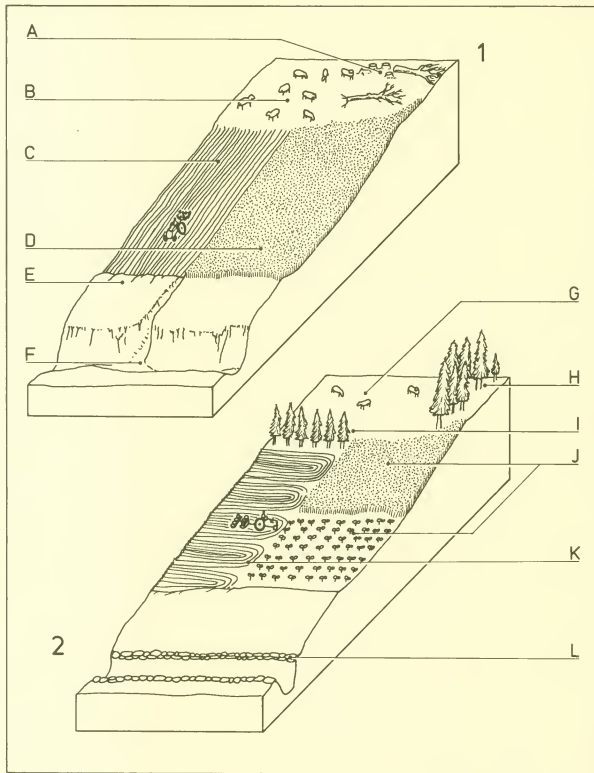
1 Causes
A Deforested land
B Overgrazing
C Down slope cultivation
D Monoculture
E Wind erosion
F Flood erosion

2 Solutions
G Reduced herds
H Reforested land
I Shelter belt
J Crop rotation
K Contour cultivation
L Strengthened river banks

©DIAGRAM

## Formation of a river valley



A  Upper course
Vertical erosion of
mountains by
streams. Creation
of ridges and
intervening valleys.

B  Middle course
Mountains reduced
to low hills by river
erosion.
Valley floor
widened.

C  Lower course
Low, wide flood
plain created by
lateral erosion.
Material deposited
on valley floor.
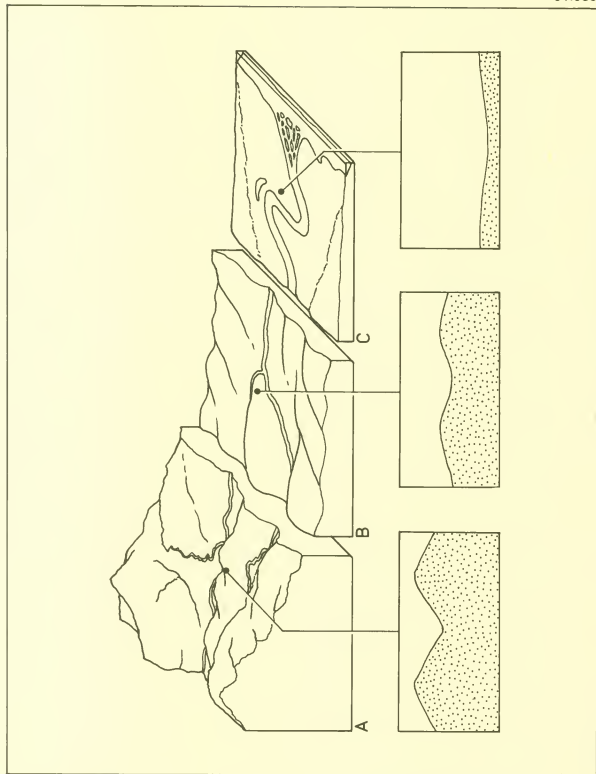
©DIAGRAM

## Development of a river
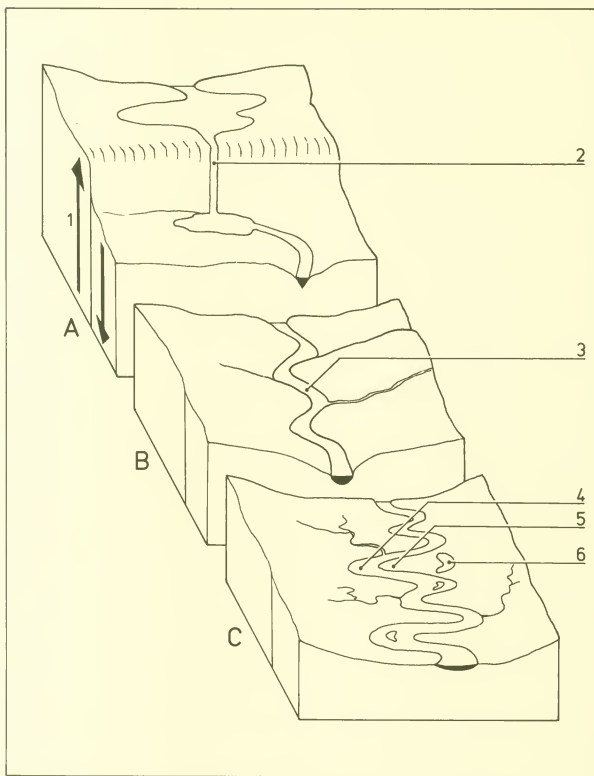
A  Young river
B  Mature river
C  Old river

1  Geological fault changes
   river bed
2  Creation of a waterfall
3  Widening of valley
4  Broad meandering
5  Deposition of sediment
6  Formation of lakes in
   abandoned meanders

## The parts of a glacier
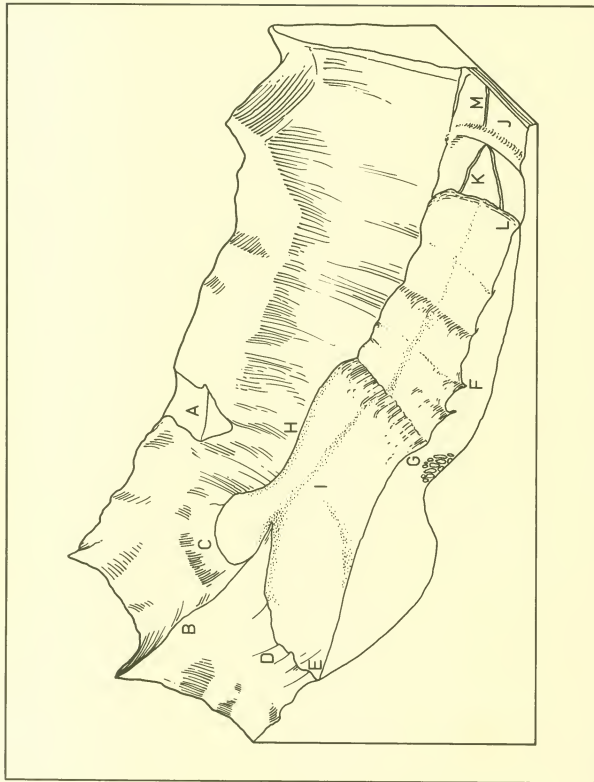
A Hanging glacier
B Arête
C Cirque
D Headwall
E Bergschrund
F Crevasses
G Icefall
H Lateral moraine
I Medial moraine
J Terminal moraine
K Glacial stream
L Glacier snout
M Outwash plain

©DIAGRAM

## Marine erosion and deposition

A

3
2
1
6
4
5

B

a
b
c
d
e
f

▨ Deposition

©DIAGRAM
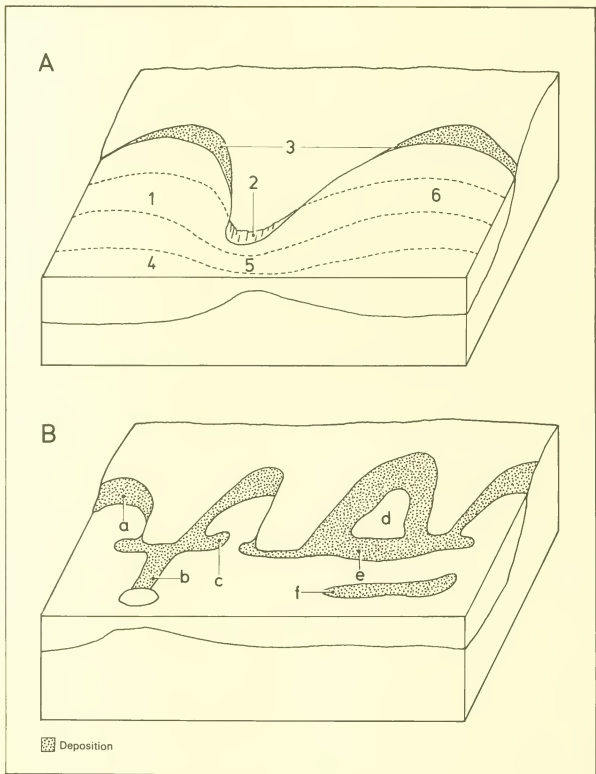
A  The process
1  Bay
2  Erosion of headland
3  Deposition of material
4  Deep water
5  Shallow water
6  Lines of breakers

B  The features
a  Berm
b  Tombolo
c  Spit
d  Lagoon
e  Baymouth bar
f  Barrier island

## Sand dunes
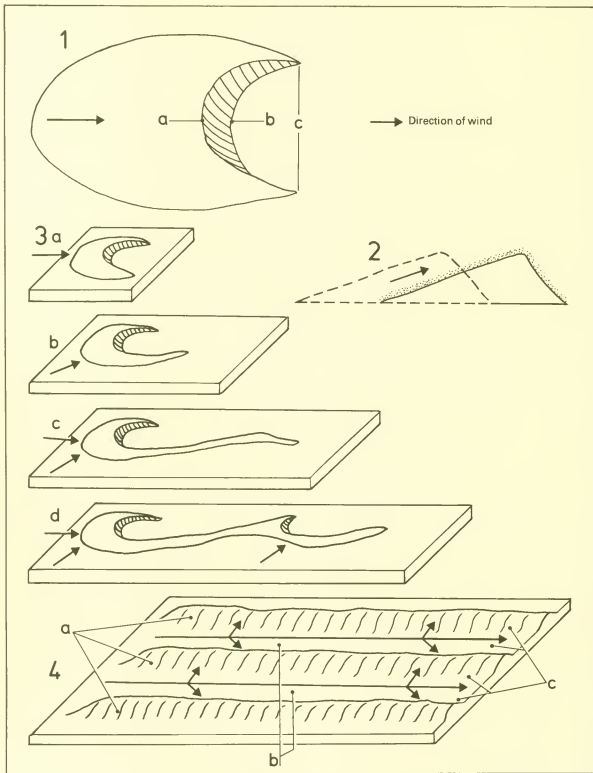
1 Barchan dune
a Windward slope
b Leeward/slip face
c Horns
2 Section through a barchan
3 Barchan into seif dune
a Barchan and prevailing wind
b Wind shifts and one horn lengthens
c Wind vacillates
d Seif dune later takes shape

4 Seif dune pattern
a Long, narrow, straight and parallel dunes
b Corridors
c Eddies

© DIAGRAM

# Population pyramid for USA

01.040



Total population, 1985, 238,740,000

Total number of females 122,579,000

Total number of males 116,161,000

| Age groups | Males (millions) | Females (millions) |
|---|---|---|
| 85+ | 0.773 | 1.938 |
| 80-84 | 1.152 | 2.176 |
| 75-79 | 2.135 | 3.359 |
| 70-74 | 3.213 | 4.354 |
| 65-69 | 4.253 | 5.176 |
| 60-64 | 5.119 | 5.878 |
| 55-59 | 5.379 | 5.957 |
| 50-54 | 5.281 | 5.661 |
| 45-49 | 5.678 | 5.968 |
| 40-44 | 6.889 | 7.166 |
| 35-39 | 8.741 | 8.966 |
| 30-34 | 10.096 | 10.170 |
| 25-29 | 10.886 | 10.865 |
| 20-24 | 10.515 | 10.480 |
| 15-19 | 9.445 | 9.108 |
| 10-14 | 8.763 | 8.340 |
| 5-9 | 8.609 | 8.214 |
| 0-4 | 9.229 | 8.806 |

Number of males in millions

Number of females in millions

©DIAGRAM

## Comparative population pyramids

01.041
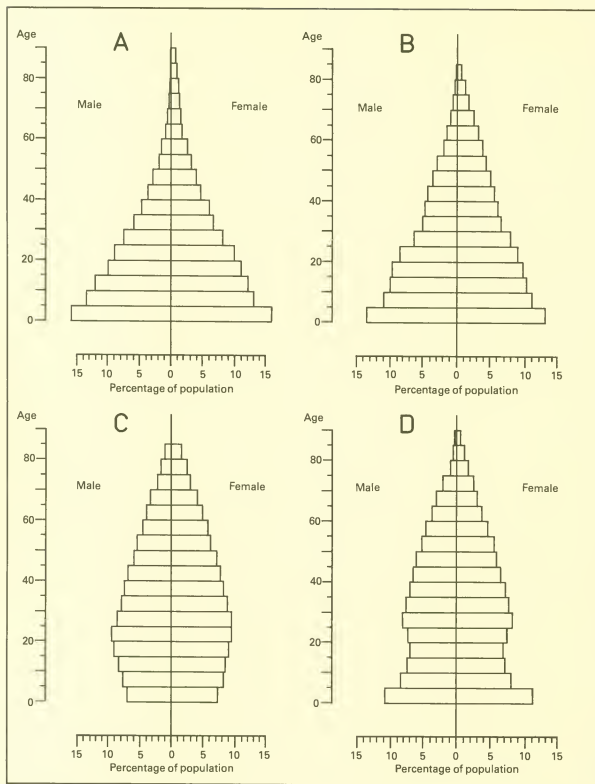


A Progressive
B Stationary
C Regressive
D Intermediate

## Area of American states (sq. mi.)

1 Alaska (570,833)
2 Texas (262,017)
3 California (156,299)
4 Montana (145,388)
5 New Mexico (121,335)
6 Arizona (113,508)
7 Nevada (109,894)
8 Colorado (103,595)
9 Wyoming (96,989)
10 Oregon (96,184)

NB Figures given are taken from 1980 estimates
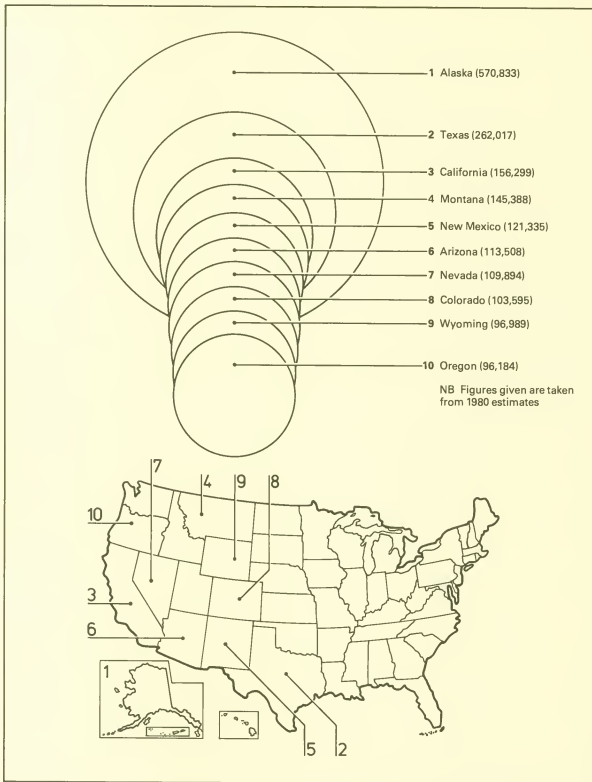
Idaho (82,412)
Utah (82,073)
Kansas (81,778)
Minnesota (79,548)
Nebraska (76,644)
South Dakota (75,952)
North Dakota (69,300)
Missouri (68,945)
Oklahoma (68,655)
Washington (66,511)

Georgia (58,056)
Michigan (56,954)
Iowa (55,965)
Illinois (55,645)
Wisconsin (54,426)
Florida (54,153)
Arkansas (52,078)
Alabama (50,767)
North Carolina (48,843)
New York (47,377)

Mississippi (47,233)
Pennsylvania (44,888)
Louisiana (44,521)
Tennessee (41,155)
Ohio (41,004)
Virginia (39,704)
Kentucky (39,669)
Indiana (35,932)
Maine (30,995)
South Carolina (30,203)

West Virginia (24,119)
Maryland (9,837)
Vermont (9,273)
New Hampshire (8,993)
Massachusetts (7,824)
New Jersey (7,468)
Hawaii (6,425)
Connecticut (4,872)
Delaware (1,932)
Rhode Island (1,055)

©DIAGRAM

## Largest American cities by population

1 New York (7,164,740)

2 Los Angeles (3,096,720)

3 Chicago (2,992,470)

4 Houston (1,705,700)

5 Philadelphia (1,646,715)

6 Detroit (1,089,975)
7 Dallas (974,235)
8 San Diego (960,450)
9 Phoenix (853,265)
10 San Antonio (842,780)

NB  Figures given are
taken from 1984 estimates

©DIAGRAM
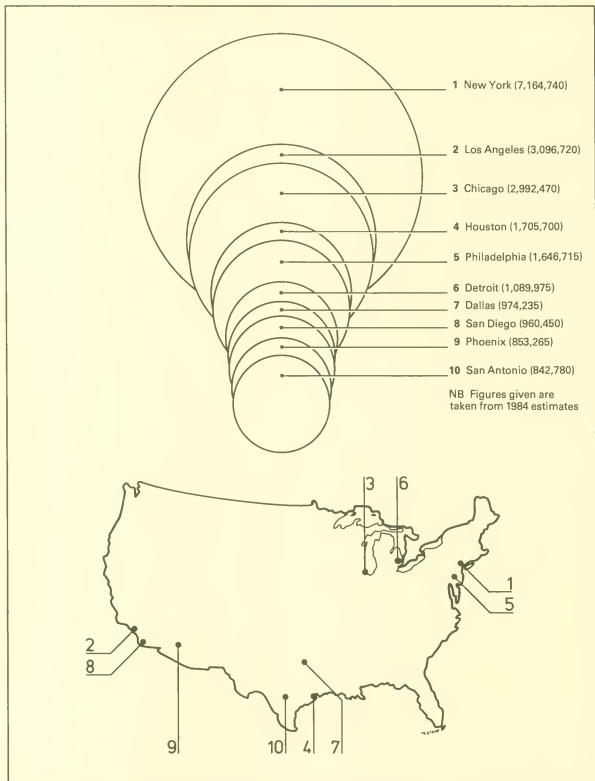
| | | |
|---|---|---|
| Honolulu (805,265) | Columbus (566,115) | Atlanta (426,090) | Tucson (365,420) |
| Baltimore (763,570) | New Orleans (559,100) | Fort Worth (414,560) | Minneapolis (358,335) |
| San Francisco (712,755) | Cleveland (546,545) | Pittsburgh (402,585) | Oakland (351,900) |
| Indianapolis (710,280) | Denver (504,590) | Austin (397,000) | Albuquerque (350,575) |
| San Jose (686,180) | Seattle (488,475) | Long Beach (378,750) | Toledo (343,940) |
| Memphis (648,340) | El Paso (463,810) | Tulsa (374,535) | Buffalo (338,980) |
| Washington (622,825) | Nashville-Davidson (462,450) | Miami (372,635) | Omaha (332,240) |
| Milwaukee (620,810) | Oklahoma City (443,170) | Cincinnati (370,480) | Charlotte (330,840) |
| Jacksonville (577,970) | Kansas City (443,075) | Baton Rouge (368,570) | Newark (314,385) |
| Boston (570,720) | St Louis (429,300) | Portland (365,860) | Virginia Beach (308,665) |

## Largest World cities by population

1 Shanghai, China (12,000,000)

2 Seoul, South Korea (9,204,300)
3 Calcutta, India (9,165,700)
4 Mexico City, Mexico (8,988,200)
5 Moscow, USSR (8,500,000)
6 Peking, China (8,500,000)
7 Tokyo, Japan (8,500,000)
8 Bombay, India (8,202,800)

9 Jakarta, Indonesia (7,636,000)

10 Tianjin, China (7,200,000)

NB Figures given are mostly taken from 1984 estimates
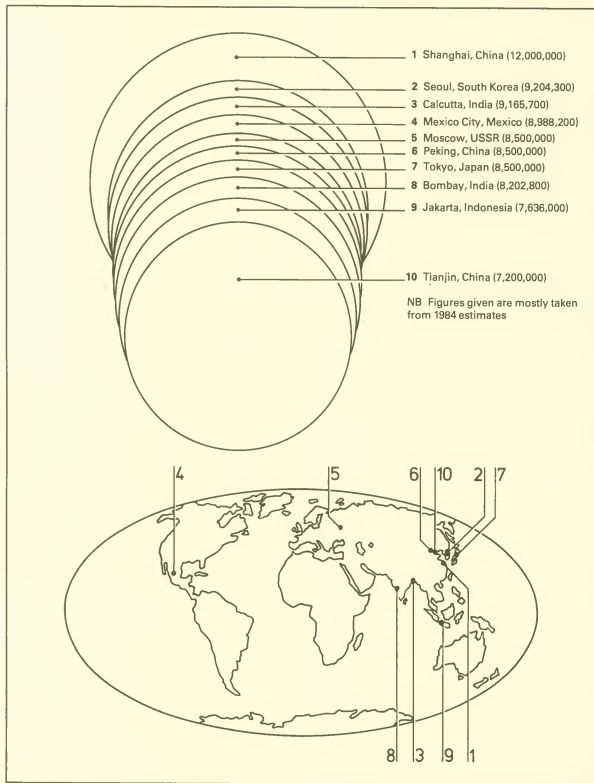
| | | | |
|---|---|---|---|
| New York (7,086,000) | Rio de Janeiro (5,093,200) | Dhaka (3,500,000) | Buenos Aires (2,908,000) |
| Sao Paulo (7,033,500) | Leningrad (4,800,000) | Ho Chih Minh City (3,500,000) | Yokohama (2,900,000) |
| London (6,756,000) | Shenyang (4,800,000) | Pusan (3,395,000) | Melbourne (2,836,800) |
| Chongqing (6,000,000) | Bangkok (4,700,000) | Sydney (3,310,000) | Rome (2,800,000) |
| Cairo (5,881,000) | Bogota (4,483,000) | Madrid (3,271,800) | Istanbul (2,772,700) |
| Teheran (5,734,200) | Wuhan (4,400,000) | Kinshasa (3,000,000) | Alexandria (2,708,000) |
| Hong Kong (5,415,000) | Madras (4,276,600) | Nanjing (3,000,000) | Caracas (2,700,000) |
| Delhi (5,277,700) | Santiago (4,271,500) | Chicago (2,997,200) | Osaka (2,600,000) |
| Canton (5,200,000) | Lima (4,164,600) | Berlin (2,985,000) | Manchester (2,594,000) |
| Karachi (5,100,000) | Baghdad (3,800,000) | Bangalore (2,913,500) | Ahmedabad (2,515,200) |

© DIAGRAM

## Mileages of American cities

| | Atlanta | Boston | Chicago | Dallas | Los Angeles | Miami | New Orleans | New York | San Francisco | Washington |
|---|---|---|---|---|---|---|---|---|---|---|
| **Atlanta** | | 1100 | 725 | 820 | 2260 | 665 | 510 | 880 | 2595 | 650 |
| **Baltimore** | 670 | 400 | 690 | 1435 | 2720 | 1140 | 1150 | 185 | 2870 | 40 |
| **Birmingham** | 155 | 1195 | 680 | 665 | 2085 | 780 | 355 | 985 | 2425 | 755 |
| **Boston** | 1100 | | 990 | 1805 | 3085 | 1565 | 1550 | 210 | 3190 | 435 |
| **Buffalo** | 955 | 455 | 530 | 1395 | 2640 | 1485 | 1245 | 360 | 2740 | 380 |
| **Chicago** | 725 | 990 | | 960 | 2120 | 1400 | 945 | 845 | 2195 | 705 |
| **Cleveland** | 700 | 630 | 345 | 1210 | 2415 | 1335 | 1075 | 475 | 2550 | 365 |
| **Dallas** | 820 | 1805 | 960 | | 1425 | 1370 | 505 | 1625 | 1785 | 1400 |
| **Detroit** | 730 | 700 | 275 | 1180 | 2400 | 1380 | 1070 | 650 | 2475 | 525 |
| **El Paso** | 1455 | 2410 | 1530 | 625 | 805 | 2005 | 1115 | 2205 | 1210 | 2045 |
| **Houston** | 840 | 1895 | 1100 | 245 | 1545 | 1220 | 360 | 1655 | 1950 | 1430 |
| **Indianapolis** | 550 | 915 | 190 | 900 | 2150 | 1220 | 825 | 720 | 2325 | 565 |
| **Kansas City** | 815 | 1420 | 510 | 495 | 1610 | 1530 | 830 | 1205 | 1890 | 1050 |
| **Las Vegas** | 2025 | 2790 | 1790 | 1240 | 285 | 2555 | 1745 | 2580 | 580 | 2440 |
| **Los Angeles** | 2260 | 3085 | 2120 | 1425 | | 2820 | 1920 | 2875 | 400 | 2725 |
| **Louisville** | 410 | 960 | 305 | 840 | 2175 | 1080 | 710 | 755 | 2430 | 600 |
| **Memphis** | 420 | 1335 | 545 | 470 | 1835 | 1030 | 395 | 1130 | 2175 | 905 |
| **Miami** | 665 | 1565 | 1400 | 1370 | 2820 | | 875 | 1340 | 3160 | 1115 |
| **Milwaukee** | 805 | 1060 | 90 | 1050 | 2175 | 1460 | 1000 | 935 | 2190 | 785 |
| **Nashville** | 250 | 1115 | 460 | 680 | 2025 | 930 | 530 | 910 | 2400 | 685 |
| **New Orleans** | 510 | 1550 | 945 | 505 | 1920 | 875 | | 1340 | 2295 | 1115 |
| **New York** | 880 | 210 | 845 | 1625 | 2875 | 1340 | 1340 | | 3020 | 230 |
| **Oklahoma City** | 905 | 1655 | 840 | 210 | 1350 | 1555 | 680 | 1525 | 1690 | 1375 |
| **Philadelphia** | 790 | 300 | 770 | 1510 | 2795 | 1250 | 1225 | 90 | 2940 | 135 |
| **Phoenix** | 1875 | 2655 | 1785 | 1020 | 385 | 2410 | 1520 | 2500 | 790 | 2340 |
| **Pittsburgh** | 710 | 575 | 470 | 1255 | 2510 | 1240 | 1080 | 365 | 2645 | 230 |
| **Reno** | 2475 | 2960 | 1940 | 1690 | 475 | 3000 | 2195 | 2785 | 220 | 2640 |
| **San Francisco** | 2595 | 3190 | 2195 | 1785 | 400 | 3160 | 2295 | 3020 | | 2875 |
| **Santa Fe** | 1445 | 2235 | 1315 | 640 | 860 | 2010 | 1140 | 2035 | 1200 | 1870 |
| **Washington** | 650 | 435 | 705 | 1400 | 2725 | 1115 | 1115 | 230 | 2875 | |

## Mileages of Canadian cities

| | Calgary | Edmonton | Halifax | Hamilton | Montreal | Ottawa | Quebec | Toronto | Vancouver | Winnipeg |
|---|---|---|---|---|---|---|---|---|---|---|
| Calgary | | 183 | 3073 | 2176 | 2282 | 2202 | 2432 | 2142 | 659 | 832 |
| Edmonton | 183 | | 3076 | 2179 | 2285 | 2205 | 2435 | 2145 | 842 | 835 |
| Ft. William | 1271 | 1274 | 1812 | 915 | 1021 | 941 | 1171 | 881 | 1929 | 439 |
| Frederickton | 2795 | 2798 | 280 | 895 | 513 | 639 | 379 | 854 | 3453 | 1963 |
| Halifax | 3073 | 3076 | | 1173 | 791 | 917 | 657 | 1132 | 3731 | 2241 |
| Hamilton | 2176 | 2179 | 1173 | | 382 | 289 | 532 | 41 | 2834 | 1344 |
| London | 2246 | 2249 | 1243 | 76 | 452 | 359 | 602 | 111 | 2904 | 1414 |
| Moncton | 2910 | 2913 | 163 | 1010 | 628 | 754 | 494 | 969 | 3568 | 2078 |
| Montreal | 2282 | 2285 | 791 | 382 | | 126 | 150 | 341 | 2940 | 1450 |
| North Bay | 1972 | 1975 | 1147 | 250 | 356 | 230 | 504 | 216 | 2630 | 1140 |
| Ottawa | 2202 | 2205 | 917 | 289 | 126 | | 274 | 248 | 2860 | 1370 |
| Quebec | 2432 | 2435 | 657 | 532 | 150 | 274 | | 491 | 3090 | 1600 |
| Regina | 478 | 497 | 2596 | 1699 | 1805 | 1725 | 1955 | 1665 | 1136 | 355 |
| St. John | 2862 | 2865 | 262 | 962 | 580 | 706 | 446 | 921 | 3520 | 2030 |
| Saskatoon | 389 | 339 | 2737 | 1840 | 1946 | 1866 | 2096 | 1806 | 1048 | 496 |
| Sault. Ste. Marie | 1601 | 1632 | 1417 | 474 | 626 | 500 | 774 | 440 | 2201 | 797 |
| Sherbrooke | 2372 | 2375 | 774 | 472 | 90 | 216 | 134 | 431 | 3030 | 1540 |
| Toronto | 2142 | 2145 | 1132 | 41 | 341 | 248 | 491 | | 2800 | 1310 |
| Vancouver | 659 | 842 | 3731 | 2834 | 2940 | 2860 | 3090 | 2800 | | 1490 |
| Victoria | 702 | 885 | 3774 | 2877 | 2983 | 2903 | 3133 | 2843 | 66 | 1533 |
| Windsor | 1868 | 1910 | 1353 | 186 | 562 | 469 | 712 | 221 | 2423 | 1079 |
| Winnipeg | 832 | 835 | 2241 | 1344 | 1450 | 1370 | 1600 | 1310 | 1490 | |

© DIAGRAM

## Mileages of World cities

| | Berlin | Bombay | Cape Town | Darwin | London | Los Angeles | Mexico City | Moscow | New York | Peking | Quebec | Rio de Janeiro | Rome | Tokyo | Wellington |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Berlin | — | | | | | | | | | | | | | | |
| Bombay | 3,910 | — | | | | | | | | | | | | | |
| Cape Town | 5,977 | 5,134 | — | | | | | | | | | | | | |
| Darwin | 8,036 | 4,503 | 6,947 | — | | | | | | | | | | | |
| London | 574 | 4,462 | 6,005 | 8,598 | — | | | | | | | | | | |
| Los Angeles | 5,782 | 8,701 | 9,969 | 7,835 | 5,439 | — | | | | | | | | | |
| Mexico City | 6,037 | 9,722 | 8,511 | 9,081 | 5,541 | 1,542 | — | | | | | | | | |
| Moscow | 996 | 3,131 | 6,294 | 7,046 | 1,549 | 6,068 | 6,688 | — | | | | | | | |
| New York | 3,961 | 7,794 | 7,081 | 9,959 | 3,459 | 2,451 | 2,085 | 4,662 | — | | | | | | |
| Peking | 4,567 | 2,964 | 8,045 | 3,728 | 5,054 | 6,250 | 7,733 | 3,597 | 6,823 | — | | | | | |
| Quebec | 3,583 | 7,371 | 7,857 | 9,724 | 3,101 | 2,579 | 2,454 | 4,242 | 439 | 6,423 | — | | | | |
| Rio de Janeiro | 6,114 | 8,257 | 3,769 | 9,960 | 5,772 | 6,296 | 4,770 | 7,179 | 4,820 | 10,768 | 5,125 | — | | | |
| Rome | 734 | 3,843 | 5,249 | 8,190 | 887 | 6,326 | 6,353 | 1,474 | 4,273 | 5,047 | 3,943 | 5,684 | — | | |
| Tokyo | 5,538 | 4,188 | 9,071 | 3,367 | 5,938 | 5,470 | 7,035 | 4,650 | 6,735 | 1,307 | 6,417 | 11,535 | 6,124 | — | |
| Wellington | 11,265 | 7,677 | 7,019 | 3,310 | 11,682 | 6,714 | 6,899 | 10,279 | 8,946 | 6,698 | 9,228 | 7,349 | 11,524 | 5,760 | — |

# Distance of World cities from New York

Kilometers | Miles

15,000
10,000

12,500

7,500

5,000

2,500

10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000

London (3459 mi)
Moscow (4662 mi)
Tokyo (6735 mi)
Los Angeles (2451 mi)
Peking (6823 mi)
Bombay (7794 mi)
Darwin (9959 mi)
Rio de Janeiro (4820 mi)
Cape Town (7801 mi)
Wellington (8946 mi)

©DIAGRAM
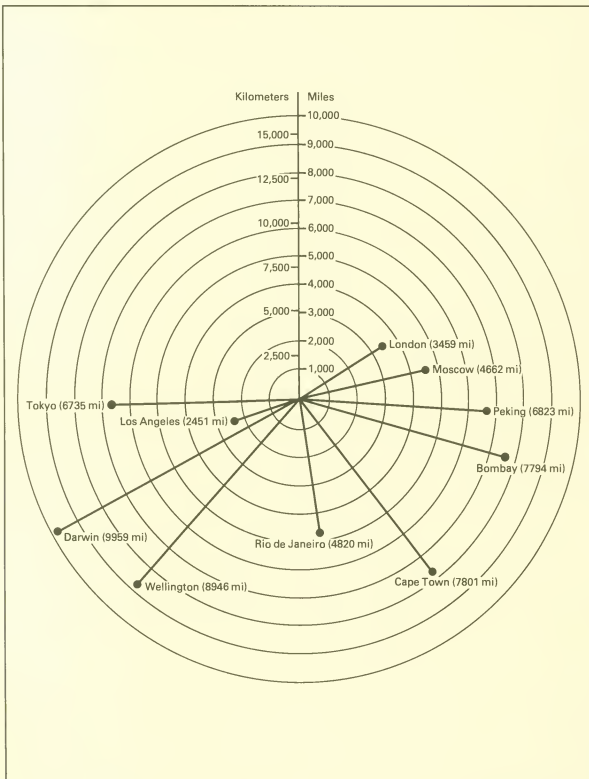
## Winter and Summer temperatures in the USA

Normal daily temperature in degrees Fahrenheit

International Falls, Minnesota
Caribou, Maine
Butte, Montana
Anchorage, Alaska
Chicago, Illinois
Detroit, Michigan
Philadelphia, Pennsylvania
New York, New York
Seattle, Washington
Las Vegas, Nevada
Phoenix, Arizona
Dallas, Texas
Tuscon, Arizona
San Antonio, Texas
San Francisco, California
Los Angeles, California
San Diego, California
Houston, Texas
Tampa, Florida
Brownsville, Texas
Miami, Florida
Key West, Florida
Honolulu, Hawaii

## World time zones

Noon
A

Midnight
B

+5 +4 +3 +2 +1 0 −1 −2 −3 −4 −5 −6 −7 −8 −9 −10 −11 +12 +11 +10 +9 +8 +7 +6

hours

©DIAGRAM

**A** Prime meridian – 0°
longitude through
Greenwich, England.
Successive zones to
the east of the
Greenwich zone
(centered on the
prime meridian) are
one hour in advance
of Greenwich Mean
Time, and successive
zones west of it are
one hour behind GMT
for every 15° interval
of longitude as
marked.
**B** International Date
Line – 180° longitude.

a  Los Angeles
b  New York
c  London
d  Johannesburg
e  Moscow
f  Tokyo
g  Sydney

Places were standard
time differs half an
hour from adjacent
zones, or which have
not adopted a zone
system.
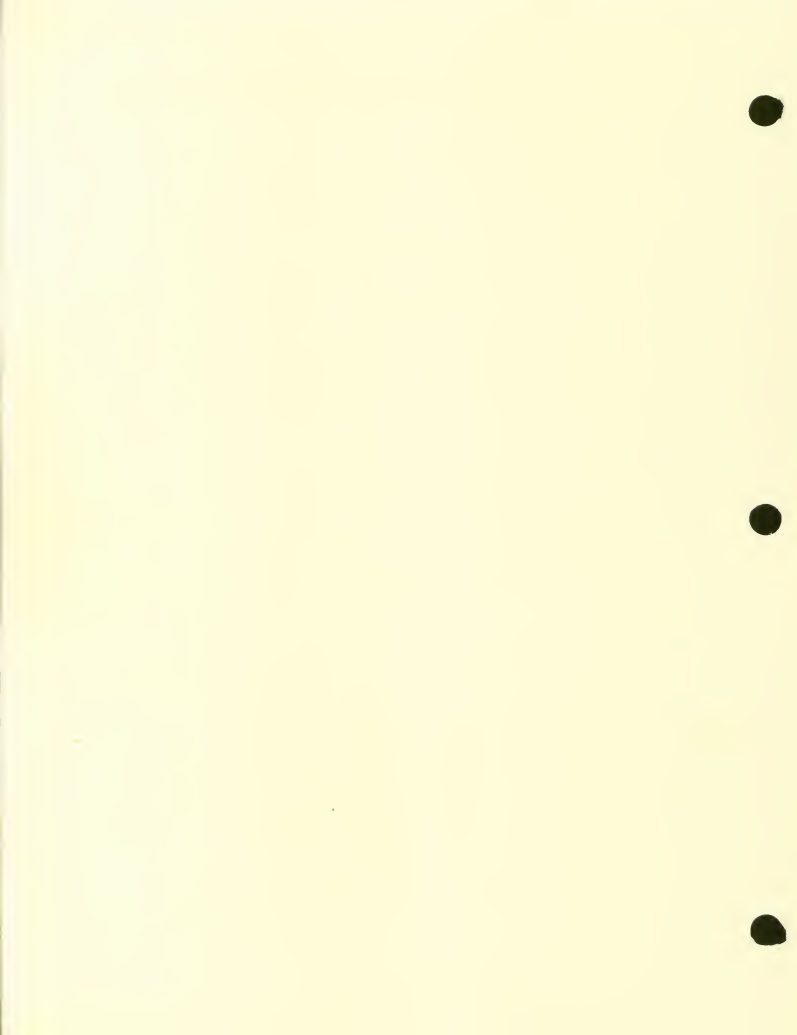
## Table of physical quantities and constants

| QUANTITY | SYMBOL | SI UNIT | ABBREVIATION |
|---|---|---|---|
| Length | l, L, x | meter | m |
| Mass | M, m | kilogram | kg |
| Time | t, T | second | s |
| Temperature | t, T, $\theta$ | degree kelvin | K |
| Force | F | newton | N |
| Energy | Q, q | joule | J |
| Pressure | P, p | pascal | Pa |
| Electric charge | Q, q | coulomb | C |
| Electric current | I, i | ampere | A |
| Potential difference | V | volt | V |
| Electrical resistance | R | ohm | $\Omega$ |
| Magnetic field intensity | B | tesla | T |

| CONSTANT | SYMBOL | SI VALUE |
|---|---|---|
| Avogadro's number | $N_A$ | $6.025 \times 10^{23}$g mole$^{-1}$ |
| Planck's constant | h | $6.625 \times 10^{-34}$Js |
| Free space velocity of light | c | $3.00 \times 10^{8}$ms$^{-1}$ |
| Electron charge | e | $1.602 \times 10^{-19}$C |
| Electron rest mass | $m_e$ | $9.11 \times 10^{-31}$kg |
| Specific electron charge | e/m | $1.760 \times 10^{11}$Ckg$^{-1}$ |
| Atomic mass unit | amu | $1.660 \times 10^{-27}$kg |
| Proton rest mass | $m_p$ | $1.6724 \times 10^{-27}$kg |
| Neutron rest mass | $m_n$ | $1.6733 \times 10^{-27}$kg |
| Stefan-Boltzmann constant | $\sigma$ | $5.67 \times 10^{-8}$Jm$^{-2}$K$^{-4}$s$^{-1}$ |
| Universal gas constant | R | $8.31$JK$^{-1}$g mole$^{-1}$ |
| Universal gravitation constant | G | $6.673 \times 10^{-11}$Nm$^2$kg$^{-2}$ |
| Boltzmann constant | k | $1.381 \times 10^{-23}$JK$^{-1}$ |

## Motion in a straight line
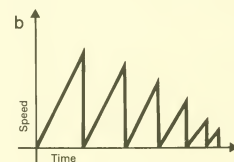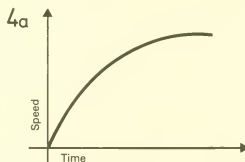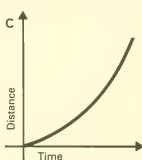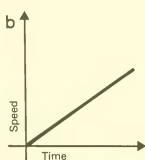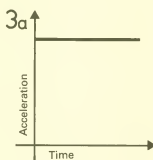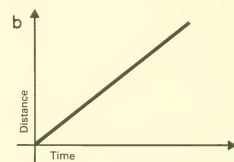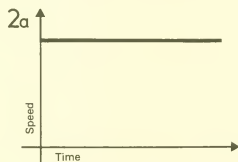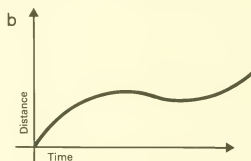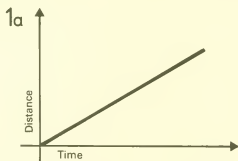
1a Uniform motion
1b Non-uniform motion
2a, 2b Motion at constant speed – acceleration zero
3a, 3b, 3c Motion with constant acceleration
4a Falling object in air
4b A bouncing ball

©DIAGRAM

## Atoms and molecules

©DIAGRAM
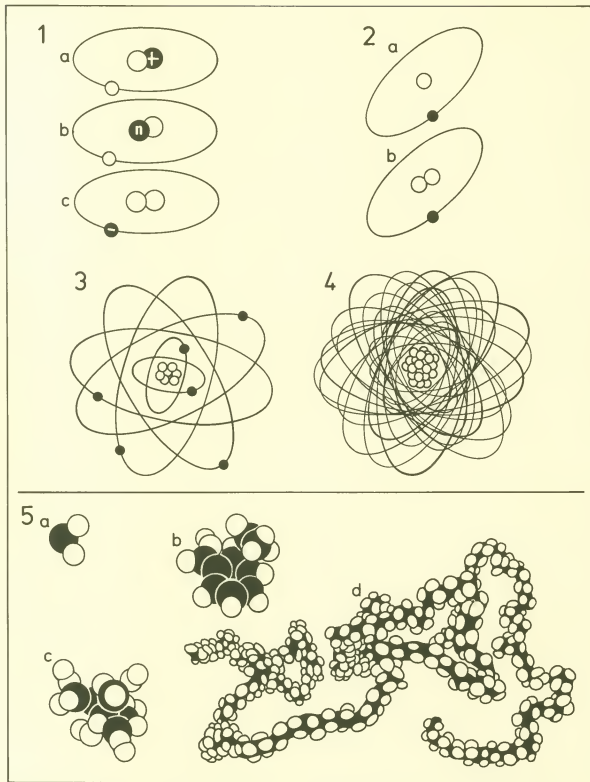
**1a** The proton – positively charged (+1.6 × $10^{-19}$C); mass = 1.6726 × $10^{-7}$kg. The number of protons (atomic number, Z) determines the identity of an element.
**1b** The neutron – electrically neutral;

mass = 1.6748 × $10^{-27}$kg. The number of protons + neutrons = A, the mass number.
**1c** The electron – negatively charged (−1.6 × $10^{-19}$kg).
**2a** Hydrogen atom – 1 proton, 1 electron.
**2b** Isotope of hydrogen

(deuterium) – 1 proton, 1 neutron, 1 electron – about 0.1% of hydrogen is deuterium.
**3** Carbon atom – 6 protons, 6 neutrons, 6 electrons.
**4** Uranium atoms – 92 protons, 92 electrons. 99.28% have 146

neutrons; other isotopes have 142 or 143 neutrons.
**5** Molecules
**5a** Water – 3 atoms
**5b** Aspirin – 21 atoms
**5c** Glucose – 24 atoms
**5d** Rubber – 65,000 atoms

## Crystal structures

Si
c

Cl
Na

© DIAGRAM
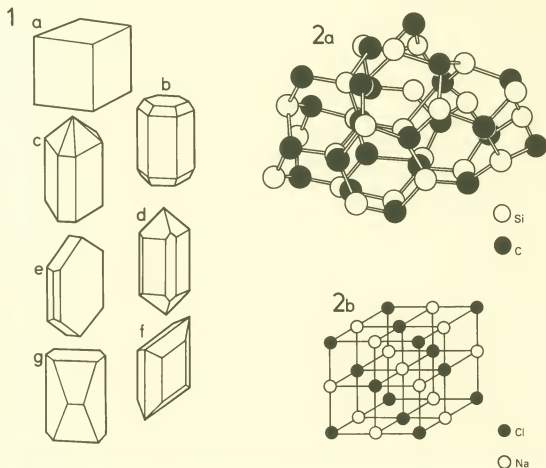
1 Crystal systems
1a Cubic
1b Hexagonal
1c Trigonal
1d Tetragonal
1e Orthorhombic
1f Monoclinic
1g Triclinic

2 Crystal bonds
2a Covalent bond – sodium chloride
2b Ionic bond – sodium chloride
3 Water crystals, e.g. snowflakes. All based on hexagonal shapes.

## The Periodic table

02.005

Based on Carbon 12 = 12.0000

NOBLE GASES VIIIA
NONMETALS
METALS
TRANSITION ELEMENTS

| IA | IIA | IIIB | IVB | VB | VIB | VIIB | | VIIIB | | IB | IIB | IIIA | IVA | VA | VIA | VIIA | VIIIA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 H | | | | | | | | | | | | | | | | | 2 He |
| 3 Li | 4 Be | | | | | | | | | | | 5 B | 6 C | 7 N | 8 O | 9 F | 10 Ne |
| 11 Na | 12 Mg | | | | | | | | | | | 13 Al | 14 Si | 15 P | 16 S | 17 Cl | 18 Ar |
| 19 K | 20 Ca | 21 Sc | 22 Ti | 23 V | 24 Cr | 25 Mn | 26 Fe | 27 Co | 28 Ni | 29 Cu | 30 Zn | 31 Ga | 32 Ge | 33 As | 34 Se | 35 Br | 36 Kr |
| 37 Rb | 38 Sr | 39 Y | 40 Zr | 41 Nb | 42 Mo | 43 Tc | 44 Ru | 45 Rh | 46 Pd | 47 Ag | 48 Cd | 49 In | 50 Sn | 51 Sb | 52 Te | 53 I | 54 Xe |
| 55 Cs | 56 Ba | 57 La | 72 Hf | 73 Ta | 74 W | 75 Re | 76 Os | 77 Ir | 78 Pt | 79 Au | 80 Hg | 81 Ti | 82 Pb | 83 Bi | 84 Po | 85 At | 86 Rn |
| 87 Fr | 88 Ra | 89 Ac | | | | | | | | | | | | | | | |

57–71 Lanthanide series

| 57 La | 58 Ce | 59 Pr | 60 Nd | 61 Pm | 62 Sm | 63 Eu | 64 Gd | 65 Tb | 66 Dy | 67 Ho | 68 Er | 69 Tm | 70 Yb | 71 Lu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

89–103 Actinide series

| 89 Ac | 90 Th | 91 Pa | 92 U | 93 Np | 94 Pu | 95 Am | 96 Cm | 97 Bk | 98 Cf | 99 Es | 100 Fm | 101 Md | 102 No | 103 Lr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

46 Pd
Atomic number
Element symbol

©DIAGRAM

## Atomic elements

| ELEMENT | SYMBOL | ATOMIC NUMBER | WEIGHT | ELEMENT | SYMBOL | ATOMIC NUMBER | WEIGHT |
|---------|--------|---------------|--------|---------|--------|---------------|--------|
| Hydrogen | H | 1 | 1.0079 | Samarium | Sm | 62 | 150.4 |
| Helium | He | 2 | 4.00260 | Europium | Eu | 63 | 151.96 |
| Lithium | Li | 3 | 6.941 | Gadolinium | Gd | 64 | 157.25 |
| Beryllium | Be | 4 | 9.01218 | Terbium | Tb | 65 | 158.9254 |
| Boron | B | 5 | 10.81 | Dysprosium | Dy | 66 | 162.50 |
| Carbon | C | 6 | 12.011 | Holmium | Ho | 67 | 164.9304 |
| Nitrogen | N | 7 | 14.0067 | Erbium | Er | 68 | 167.26 |
| Oxygen | O | 8 | 15.9994 | Thulium | Tm | 69 | 168.9342 |
| Fluorine | F | 9 | 18.998403 | Ytterbium | Yb | 70 | 173.04 |
| Neon | Ne | 10 | 20.179 | Lutetium | Lu | 71 | 174.967 |
| Sodium | Na | 11 | 22.9898 | Hafnium | Hf | 72 | 178.49 |
| Magnesium | Mg | 12 | 24.305 | Tantalum | Ta | 73 | 180.9479 |
| Aluminium | Al | 13 | 26.98154 | Tungsten | W | 74 | 183.85 |
| Silicon | Si | 14 | 28.0855 | Rhenium | Re | 75 | 186.2 |
| Phosphorus | P | 15 | 30.97376 | Osmium | Os | 76 | 190.2 |
| Sulfur | S | 16 | 32.06 | Iridium | Ir | 77 | 192.22 |
| Chlorine | Cl | 17 | 35.453 | Platinum | Pt | 78 | 195.09 |
| Argon | Ar | 18 | 39.948 | Gold | Au | 79 | 196.9665 |
| Potassium | K | 19 | 39.0983 | Mercury | Hg | 80 | 200.59 |
| Calcium | Ca | 20 | 40.08 | Thallium | Tl | 81 | 204.37 |
| Scandium | Sc | 21 | 44.9559 | Lead | Pb | 82 | 207.2 |
| Titanium | Ti | 22 | 47.90 | Bismuth | Bi | 83 | 208.9808 |
| Vanadium | V | 23 | 50.9415 | Polonium | Po | 84 | 208.98244* |
| Chromium | Cr | 24 | 51.996 | Astatine | At | 85 | 209.98704* |
| Manganese | Mn | 25 | 54.9380 | Radon | Rn | 86 | 222* |
| Iron | Fe | 26 | 55.847 | Francium | Fr | 87 | 223.01976* |
| Cobalt | Co | 27 | 58.9332 | Radium | Ra | 88 | 226.0254* |
| Nickel | Ni | 28 | 58.71 | Actinium | Ac | 89 | 227.02779* |
| Copper | Cu | 29 | 63.546 | Thorium | Th | 90 | 232.0381 |
| Zinc | Zn | 30 | 65.38 | Protactinium | Pa | 91 | 231.0359* |
| Gallium | Ga | 31 | 69.737 | Uranium | U | 92 | 238.029 |
| Germanium | Ge | 32 | 72.59 | Neptunium | Np | 93 | 237.0482* |
| Arsenic | As | 33 | 74.9216 | Plutonium | Pu | 94 | 244.06424* |
| Selenium | Se | 34 | 78.96 | Americium | Am | 95 | 243.06139* |
| Bromine | Br | 35 | 79.904 | Curium | Cm | 96 | 247.07038* |
| Krypton | Kr | 36 | 83.80 | Berkelium | Bk | 97 | 247.07032* |
| Rubidium | Rb | 37 | 85.4678 | Californium | Cf | 98 | 251.07961* |
| Strontium | Sr | 38 | 87.62 | Einsteinium | Es | 99 | 254.08805* |
| Yttrium | Y | 39 | 88.9059 | Fermium | Fm | 100 | 257.09515* |
| Zirconium | Zr | 40 | 91.22 | Mendelevium | Mv | 101 | 258* |
| Niobium | Nb | 41 | 92.9064 | Nobelium | No | 102 | 255.093* |
| Molybdenum | Mo | 42 | 95.94 | Lawrencium | Lw | 103 | 258.099* |
| Technetium | Tc | 43 | 96.9062* | | | | |
| Ruthenium | Ru | 44 | 101.07 | | | | |
| Rhodium | Rh | 45 | 102.9055 | | | | |
| Palladium | Pd | 46 | 106.4 | | | | |
| Silver | Ag | 47 | 107.868 | | | | |
| Cadmium | Cd | 48 | 112.41 | | | | |
| Indium | In | 49 | 114.82 | | | | |
| Tin | Sn | 50 | 118.69 | | | | |
| Antimony | Sb | 51 | 121.75 | | | | |
| Tellurium | Te | 52 | 127.60 | | | | |
| Iodine | I | 53 | 126.9045 | | | | |
| Xenon | Xe | 54 | 131.30 | | | | |
| Cesium | Cs | 55 | 132.9054 | | | | |
| Barium | Ba | 56 | 137.33 | | | | |
| Lanthanum | La | 57 | 138.9055 | | | | |
| Cerium | Ce | 58 | 140.12 | | | | |
| Praseodymium | Pr | 59 | 140.9077 | | | | |
| Neodymium | Nd | 60 | 144.24 | | | | |
| Promethium | Pm | 61 | 144.91279* | | | | |

*atomic weight of the isotope with the longest known half-life

© DIAGRAM

# Air and water



1 Water content of human body
1a average young man 65%
1b middle-aged woman 50%
An average adult needs 2½ quarts of water a day. Some of this can be obtained from food.
2 Mineral content of bottled water
3 Percentages of gases in clean dry air
A Nitrogen 78%
B Oxygen 20.8%
C Argon 0.9%
D Carbon dioxide 0.03%
E Other gases 0.27% (helium, neon, krypton, xenon, hydrogen)
4 Gases breathed in and out
a Oxygen 208 cu.cm in 170 cu.cm out
b Nitrogen 780 cu.cm in 780 cu.cm out
c Carbon dioxide 0.3 cu.cm in 38.3 cu.cm out
d Other gases 11.7 cu.cm in 11.7 cu.cm out
5 Water content of some foods
Sugar 0%
Salt 0%
Butter 9%
Cheese 26%
Ham 38%
Bread 42%
Chicken 55%
Beef 70%
Eggs 74%
Tomatoes 94%
Cucumber 95%
Lettuce 97%

Calcium carbonate
Magnesium sulfate
Magnesium chloride
Sodium chloride
Silicon dioxide
Sodium nitrate
Potassium nitrate
Carbon
Fluoride
Iron

©DIAGRAM

## Atmospheric pressure

| Pressure (mb) | Height (ft) | (m) |
|---|---|---|
| 1013.25 | 0 | 0 |
| 1000 | 361 | 110 |
| 500 | 18,290 | 5575 |
| 10 | 98,424 | 30,000 |
| 1 | 164,040 | 50,000 |

©DIAGRAM
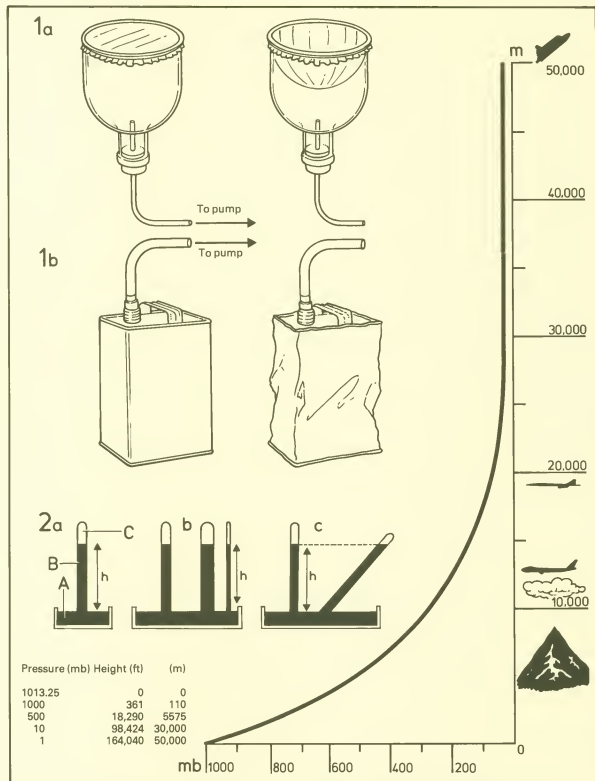
**1** To show air has weight
**1a** When air is pumped out of the rubber membrane, it sags
**1b** When air is pumped out of the can, it collapses
**2** Air supports a column of mercury
**2a** A, B = mercury
    C = vacuum
    h = 76 cm at sea level

**2b, 2c** h = 76 cm whatever diameter of tube is used or when tilted
**3** How atmospheric pressure varies with height
    1000mb = 76cm of mercury

## Energy changes
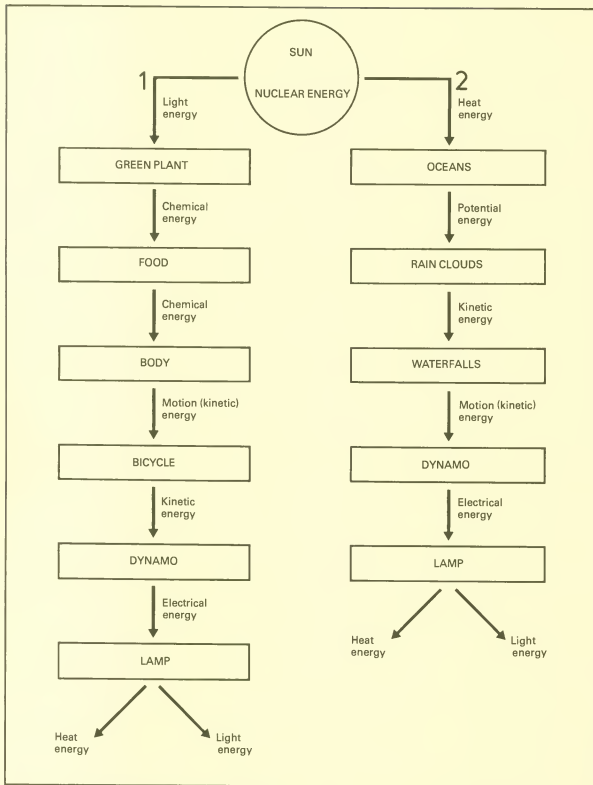
Two ways of getting heat and light energy from the sun which can be used at night.
1 A bicycle dynamo
2 Hydroelectricity

© DIAGRAM

# Heat transfer types

©DIAGRAM
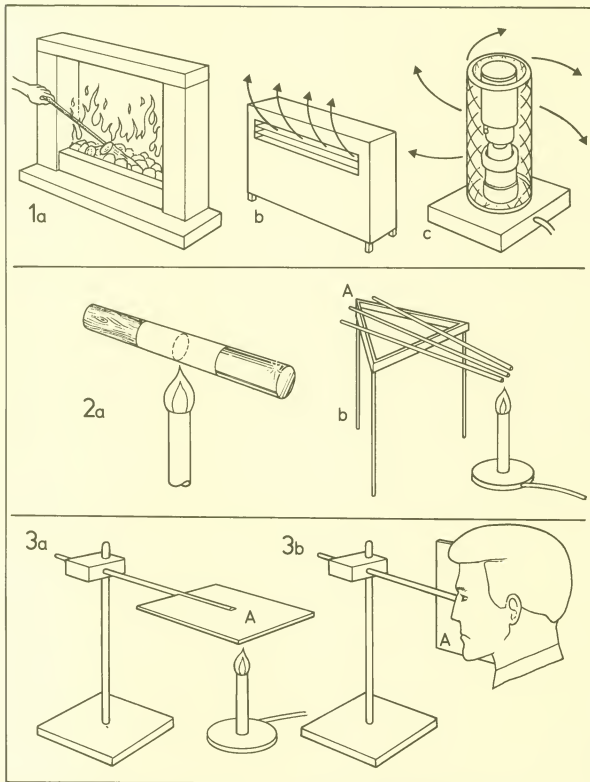
**1a** Heat travels along the poker by *conduction*.
**1b** A *convector* fire.
**1c** Heat is *radiated* by this fire.
**2a** Brass conducts heat away faster than wood so paper nearest to the wood chars first.
**2b** Move an unlighted match along the ends (A) of three heated metal rods (eg iron, copper, aluminum). It ignites first on copper.

**3** Experiments with radiation
**3a** One side of a copper sheet is painted black (A) and heated.
**3b** The painted side feels warmer when put near side of face.

## Electromagnetic spectrum

02.011



Logarithmic scale of frequency in Hz

Logarithmic scale of wavelengths in meters

$3 \times 10^{14}$ Hz

$10^{-5}$ meters

C

$10^4$   $10^6$   $10^8$   $10^{10}$   $10^{12}$   $10^{14}$   $10^{16}$   $10^{18}$   $10^{20}$

$10^4$   $10^2$   1   $10^{-2}$   $10^{-4}$   $10^{-6}$   $10^{-8}$   $10^{-10}$   $10^{-12}$

Radio

Microwaves

Long waves

Infrared

Ultraviolet

X-rays

γ-rays

Visible

B

Radium

1

2

3

$3 \times 10^{15}$ Hz

$3 \times 10^{16}$ Hz

$10^{-7}$ meters

A
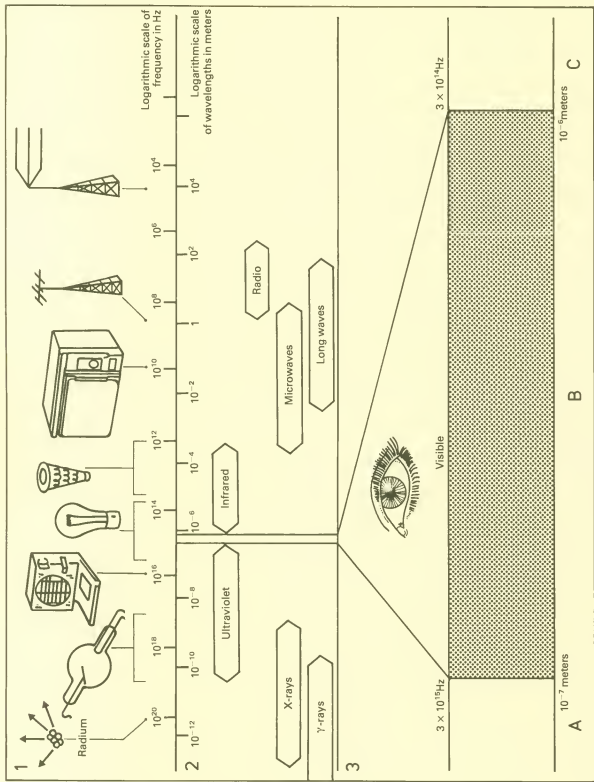
©DIAGRAM

1 Some sources of
  electromagnetic
  waves
2 Spectrum of
  electromagnetic
  waves
3 A detail of the
  spectrum
  A = ultraviolet
  B = visible (violet, blue,
      green, orange, red)
  C = infrared

## Lenses
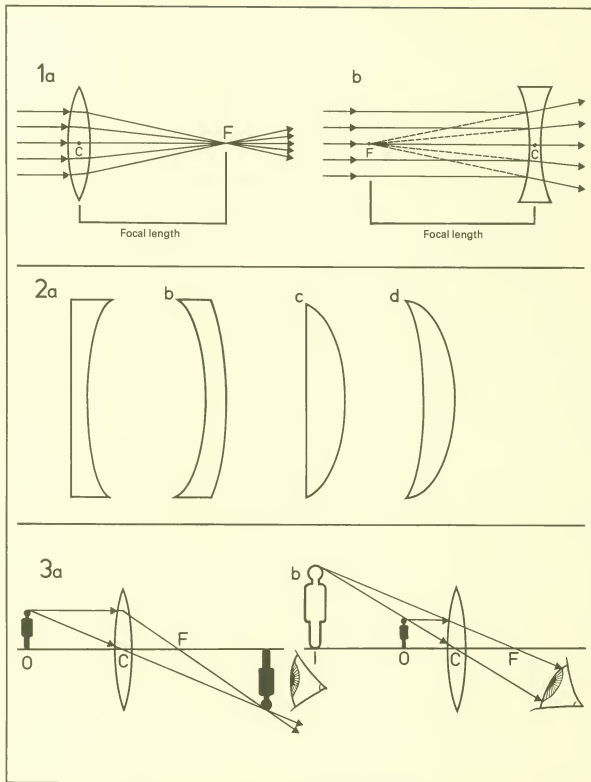
©DIAGRAM

**1a** Convex (converging) lens
**1b** Concave (diverging) lens
 **2** Other types of lens
**2a** Plano-concave (diverging)
**2b** Convexo-concave (diverging)
**2c** Plano-convex (converging)
**2d** Concavo-convex (converging)

 **3** Forming an image
**3a** A real, inverted, magnified image
**3b** A virtual, upright, magnified image (simple
 magnifying glass)

C = center of curvature
F = principal focus
I = image
O = object

# The eye

1 The human eye
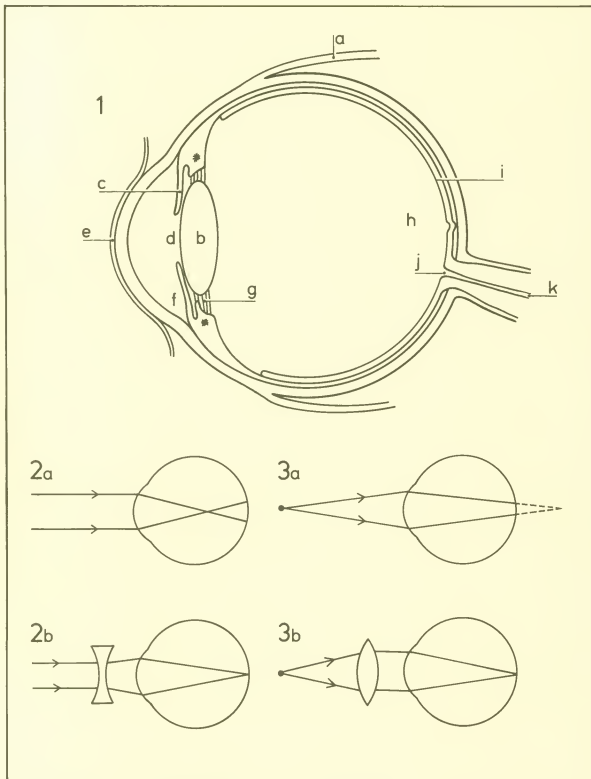
| | | | | | |
|---|---|---|---|---|---|
| **1** | The human eye | **1j** | Blind spot | **3** | Long sight and correction |
| **1a** | Muscle | **1k** | Optic nerve | | |
| **1b** | Lens | **2** | Short sight and correction | **3a** | Light from near object is focused beyond the retina |
| **1c** | Iris | **2a** | Light from distant object is focused before the retina | | |
| **1d** | Pupil | | | **3b** | A positive (convex) lens corrects the focusing |
| **1e** | Cornea | **2b** | A negative (concave) lens corrects the focusing | | |
| **1f** | Aqueous humor | | | | |
| **1g** | Suspensory ligaments | | | | |
| **1h** | Vitreous humor | | | | |
| **1i** | Retina | | | | |

© DIAGRAM

## Sound waves and music

1



2a

b

c

d



3a

C# D#    F# G# A#

Db Eb    Gb Ab Bb

| C | D | E | F | G | A | B | C |
|---|---|---|---|---|---|---|---|
| 262 | 294 | 330 | 349 | 392 | 440 | 494 | 523 |

DO  RE  MI  FA  SO  LA  TE  DO

©DIAGRAM
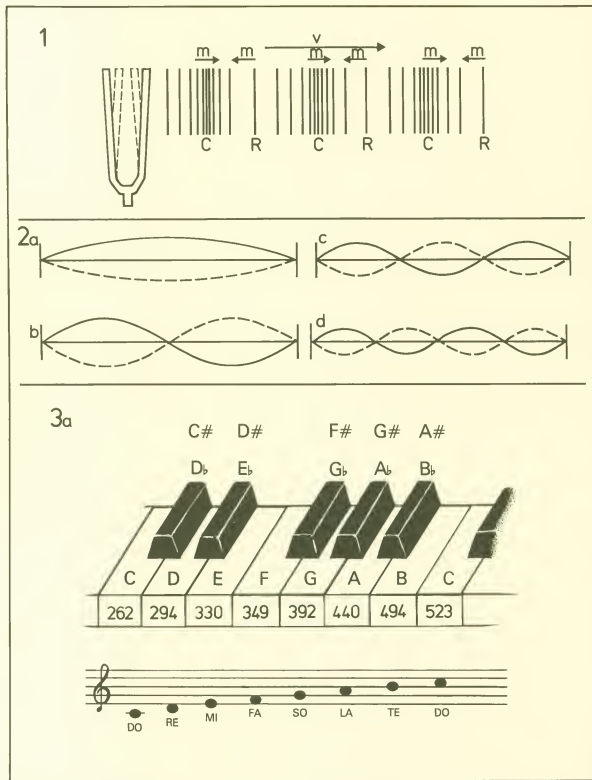
1 Sound from a tuning fork
  V = direction of travel of wave
  m = direction of motion of molecules
  C = compression
  R = rarefaction
2 Waves in a string
2a Fundamental wave length = twice the length of string
2b First harmonic wave length = length of string

2c Second harmonic wave length = two-thirds the length of string
2d Third harmonic wave length = half the length of string
3 The equally tempered musical scale
3a Musical scales
  Numbers show the frequency between each of the 13 notes
3b Staff notation and tonic sol-fa notation

## Noises and decibel ratings

| | Distance | | Decibel rating |
|---|---|---|---|
| A Whisper | 5m | 15ft | 30dB |
| B Inside an urban home | | | 50dB |
| C Light traffic | 15m | 50ft | 55dB |
| D Normal conversation | 1m | 3ft | 60dB |
| E Pneumatic drill | 15m | 50ft | 85dB |
| F Heavy traffic | 15m | 50ft | 90dB |
| G Loud shout | 15m | 50ft | 100dB |
| H Jet taking off | 600m | 2000ft | 105dB |
| I Disco at full volume | | | 117dB |
| J Jet taking off | 60m | 200ft | 120dB |

Noises rated at 120–130dB cause pain; above 140dB can cause permanent ear damage.

© DIAGRAM

## Radio and television waves

**1**

RW→

DR

D

R

λ/4

λ/4

λ/4

λ = Wave length

**2**

LSW

SW

SPW

TA

GW

SD

I

E

**3**

| | LONG WAVES 30 kHz– 300 kHz | MEDIUM WAVES 300 kHz– 3 MHz | SHORT WAVES 3 MHz– 30 MHz | VHF (VERY HIGH FREQUENCY) 30 MHz– 300 MHz | UHF (ULTRA HIGH FREQUENCY) 300 MHz– 3000 MHz | MICROWAVES above 3000 MHz |
|---|---|---|---|---|---|---|
| GROUND WAVE | Medium range communication | Local sound broadcasts | | | | |
| SKY WAVE | Long range communication | Distant sound broadcasts | Distant sound broadcasts and communication | | | |
| SPACE WAVE | | | | F.M. sound broadcasts TV | TV | Radar, Radio-astronomy, Satellite communication, Telephone links |

©DIAGRAM

**1** Aerials
**1a** Simple dipole
**1b** Improving aerial performance
   **R** = Reflector
   **D** = Dipole
  **DR** = Directors
  **RW** = Radio wave

**2** Transmission of radio waves
   **TA** = Transmitting aerial
  **LSW** = Lost sky wave
   **SW** = Sky wave
  **SPW** = Space wave
  **GW** = Ground wave
   **E** = Earth
   **I** = Ionosphere
  **SD** = Skip distance

**3** Frequency bands

## Electric circuits: 1
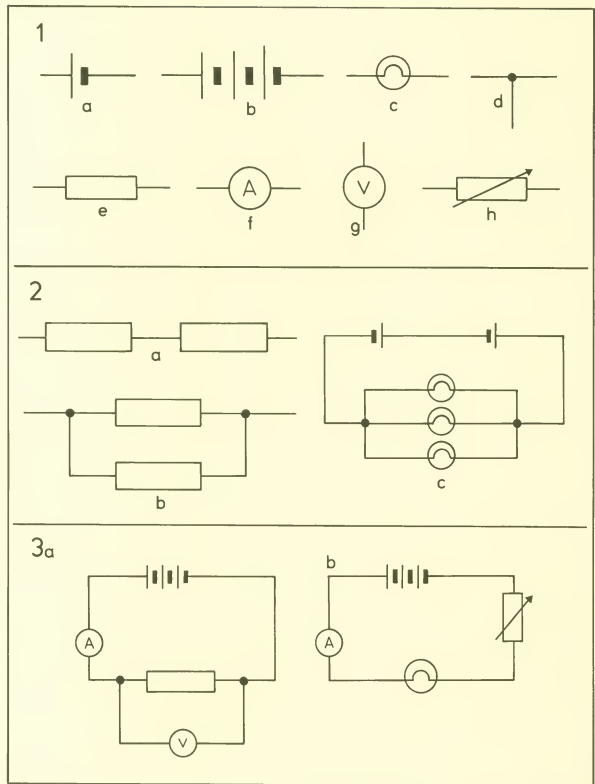
**1** Circuit symbols
**1a** Cell
**1b** Battery
**1c** Lamp
**1d** Wires joining
**1e** Resistor
**1f** Ammeter
**1g** Voltmeter
**1h** Variable resistor

**2** Series and parallel
**2a** Resistors in series
**2b** Resistors in parallel
**2c** Lamps in parallel
**3** Complete circuits
**3a** Measuring the current through a resistor and the voltage across it
**3b** Varying the current through a lamp

## Electric circuits: 2
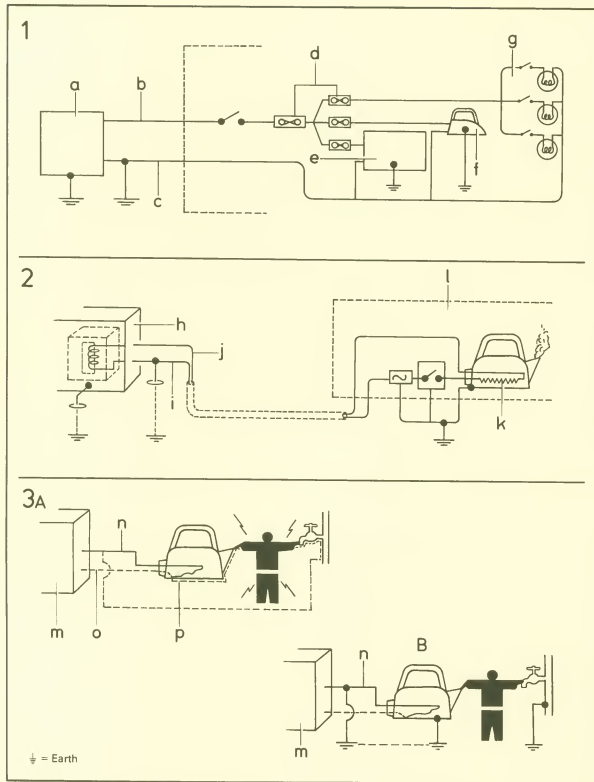
⏚ = Earth

| | | |
|---|---|---|
| **1** Use of fuses | **2** Safe wiring | **3** Faulty wiring |
| **a** Sub-station | **h** Sub-station | **A** Unsafe – no earths |
| **b** Live | **i** Neutral | **m** Mains |
| **c** Neutral | **j** Live | **n** Neutral |
| **d** Fuses | **k** Heating element | **o** Live |
| **e** Cooker | **l** House | **p** Live wire damaged and touches kettle |
| **f** Iron | | **B** Safe – earthed. Fuses now blow |
| **g** Lamps | | |

## Electronic logic gates and truth tables

©DIAGRAM
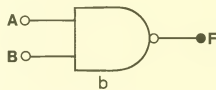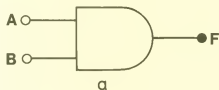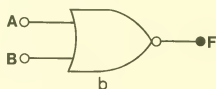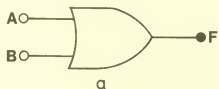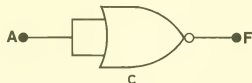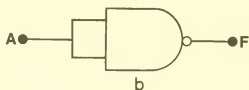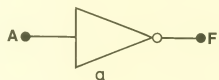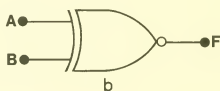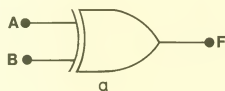
**1a** AND gate

| A | B | F |
|---|---|---|
| 0 | 0 | 0 |
| 1 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 1 | 1 |

**1b** NAND gate

| A | B | F |
|---|---|---|
| 0 | 0 | 1 |
| 1 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 1 | 0 |

**2a** OR gate

| A | B | F |
|---|---|---|
| 0 | 0 | 0 |
| 1 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 1 | 1 |

**2b** NOR gate

| A | B | F |
|---|---|---|
| 0 | 0 | 1 |
| 1 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 1 | 0 |

**3a** NOT gate (inverter)

| A | F |
|---|---|
| 0 | 1 |
| 1 | 0 |

**3b** From NAND gate

**3C** From NOR gate

**4a** EXCLUSIVE OR gate

| A | B | F |
|---|---|---|
| 0 | 0 | 0 |
| 1 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 1 | 0 |

**4b** EXCLUSIVE NOR gate

| A | B | F |
|---|---|---|
| 0 | 0 | 1 |
| 1 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 1 | 1 |

A, B = Input
F = Output

## Electrostatics
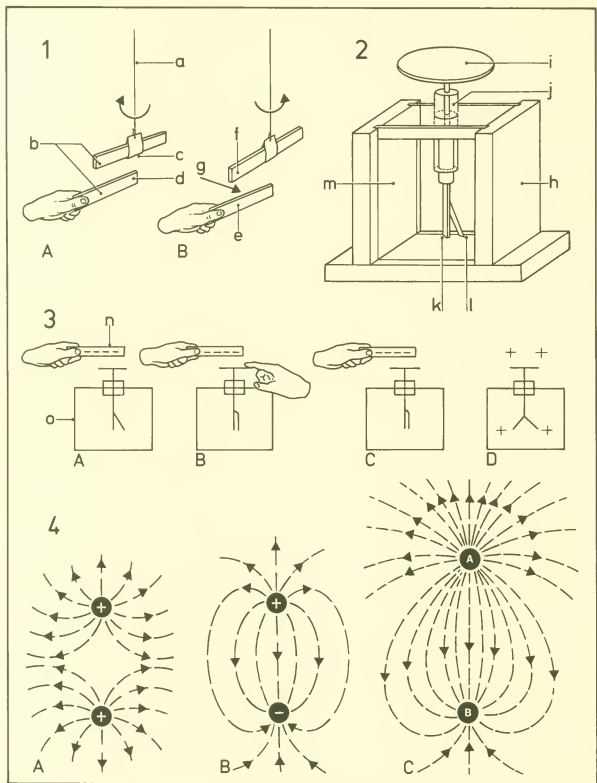
**1** Demonstrating the two
   kinds of change
**A** Like charges repel
**a** Cotton thread
**b** Polythene strip
**c** Paper stirrup
**d** Ends rubbed with cloth
**B** Unlike charges attract
**e** Polythene rod

**f** Acetate rod
**g** Ends rubbed with cloth
**2** Gold leaf electroscope
**h** Wooden box
**i** Metal cap
**j** Perspex plug
**k** Metal plate
**l** Gold leaf
**m** Glass window

**3** Charging an
   electroscope positively
**n** Charged polythene rod
**o** Gold leaf electroscope
**A** Bring up charged rod
**B** Touch metal cap
**C** Remove finger
**D** Remove rod

**4** Electric fields
**A** Two like charges
**B** Two unlike charges
**C** Two unlike charges:
   B larger than A

©DIAGRAM

# Magnetic fields

C = Compass needle
I = Current
B = Magnetic field
F = Force
G = Galvanometer
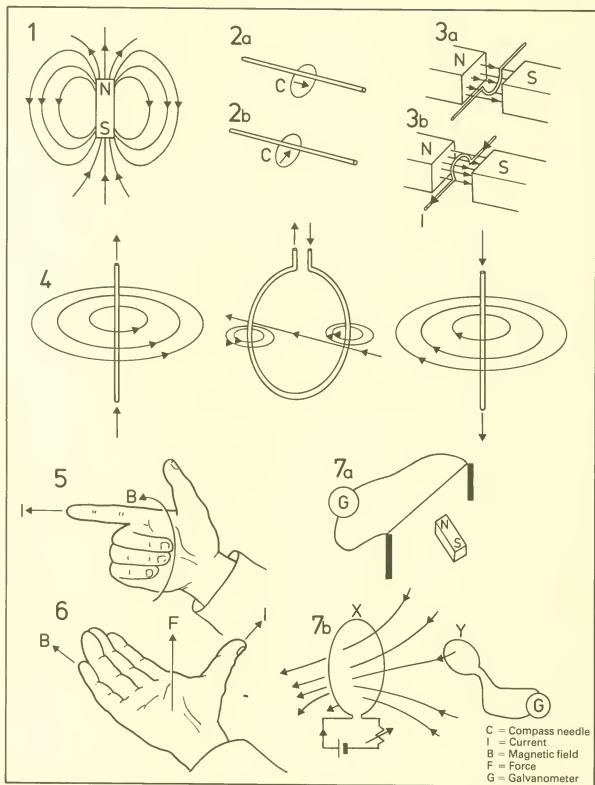
1 The magnetic field pattern of a bar magnet
2 When a current flows in the wire, the compass needle deflects
2a No current in wire
2b Current in wire
3 Demonstrating that a force is exerted on a current-carrying wire
3a No current
3b Current

4 Showing magnetic field patterns round a straight wire and a coil
5 Demonstrating the corkscrew rule for finding the direction of a magnetic field
6 Demonstrating the rule for finding the direction of the force
7 Induced current
7a If the magnet is moved, a current is registered by G
7b If the current is changed in X, a current is registered in Y

## Radioactivity: 1

**1**

| NAME | RELATIVE MASS | CHARGE | NATURE |
|------|---------------|--------|--------|
| Alpha $\alpha$ | 8000 | +2e | Helium nucleus |
| Beta $\beta$ | 1 | ±1e | Electrons |
| Gamma $\gamma$ | 0 | 0 | High frequency electromagnetic radiation |

**2**



4cm

α
β
γ

**3**



a  b  c  c  d  d

3mm  6mm

α
β
γ

©DIAGRAM

1 Types of radiation
2 Range in air
3 Penetrating power
a Gold foil
b Paper
c Aluminum sheet
d Lead sheet

Transmutation of elements

NOW — Stable atom / Radioactive atom

LATER — Same / Same

SOME DAY — Same / Entirely different

Alpha particle

$^{226}_{88}$Ra $^{88\oplus}_{138\bullet}$ Radium

$^4_2$He + $^{222}_{86}$Rn $^{86\oplus}_{136\bullet}$ Radon

$^4_2$He + $^{218}_{84}$Po $^{84\oplus}_{134\bullet}$ Polonium

$^4_2$He + $^{214}_{82}$Pb $^{82\oplus}_{132\bullet}$ Lead

e⁻ + $^{214}_{83}$Bi $^{83\oplus}_{131\bullet}$ Bismuth

4 steps omitted

$^{206}_{82}$Pb $^{82\oplus}_{124\bullet}$ Stable lead

$^2_2$⊕●

© DIAGRAM

## Radioactivity: 3

Radioactive atoms with half-life of 5 days

Start → 5 days → 10 days → 15 days → Doomsday

| RADIOISOTOPES | TYPE OF DECAY | HALF-LIFE | EXAMPLE OF USE |
|---|---|---|---|
| $^{24}_{11}$Na | $\beta^-$ | 15 hours | Studying blood circulation |
| $^{82}_{35}$Br | $\beta^-, \gamma$ | 35.9 hours | Detecting leaks in underground pipes |
| $^{198}_{79}$Au | $\beta^-, \gamma$ | 2.7 days | Cancer treatment |
| $^{131}_{53}$I | $\beta^-, \gamma$ | 8.05 days | Testing thyroid gland activity |
| $^{59}_{26}$Fe | $\beta^-, \gamma$ | 45.1 days | Testing automobile parts |
| $^{60}_{27}$Co | $\beta^-, \gamma$ | 5.2 years | Disinfecting goats' hair |
| $^{238}_{94}$Pu | $\alpha, \gamma$ | 89.6 years | Powering heart pacemakers |
| $^{14}_{6}$C | $\beta^-$ | 5570 years | Radiometric dating |
| $^{239}_{94}$Pu | $\alpha, \gamma$ | $2.4 \times 10^4$ years | Nuclear reactors |
| $^{235}_{92}$U | $\alpha, \gamma$ | $7.2 \times 10^8$ years | Nuclear reactors |
| $^{40}_{19}$K | $\beta^-, \gamma$ | $1.3 \times 10^9$ years | Radiometric dating |

©DIAGRAM

# The uses of oil

Synthetic rubbers, fibers, plastics, etc.

Olefins

Benzene

Toluene

Gas oil

Diesel oil

Fuel oil

Lubricating oils and greases

Combined to make other useful chemicals

Broken down to form other useful chemicals

Gas

Gasoline

Aviation gasoline

White spirit

Kerosene

Residual oils and solids

Paraffin wax

Petroleum jelly

Bitumen

Crude oil

©DIAGRAM

## The uses of coal

Toluene
Pyridine
Naphthalene
Anthracene oil
Asphalt

Methanol
Gasoline
Diesel fuel
Lubricating oils
Waxes

Benzene
Xylene
Phenol
Creosote
Pitch

Synthesis gas
Acetylene

Coal gas
Ammonia
Sulfur dioxide
Coal tar

Coke

Coal

©DIAGRAM

## Polymers

1 Part of a molecule of poly(ethene)
a Hydrogen atoms
b Carbon atoms
2 Part of a molecule of poly(phenylethene)
c Hydrogen atoms
d Carbon atoms
3 Production of polythene
e Ethylene gas, solvent and catalyst
f Separator

g Filter
h Precipitation tank
i Alcohol
j Centrifuge
k Dryer
l Polymer

©DIAGRAM

# Carbon

02.028
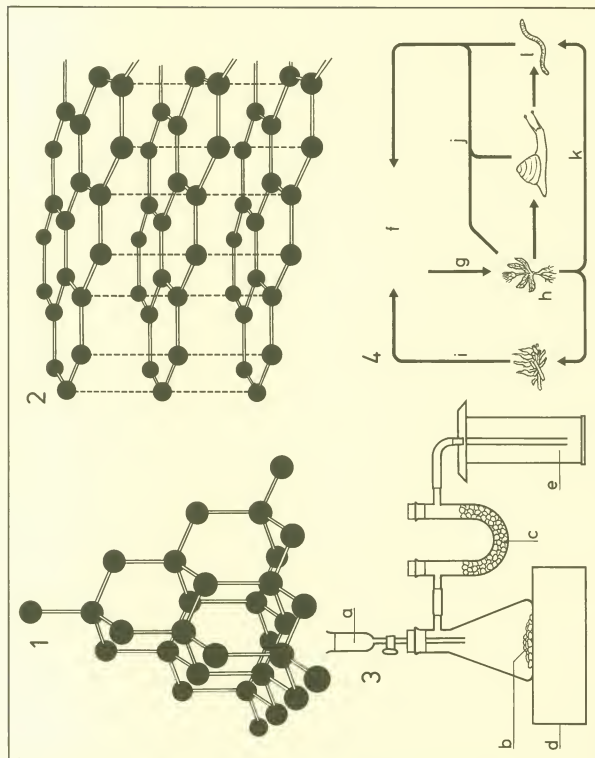


1 The structure of diamond
2 The structure of graphite
3 The preparation of carbon dioxide
a Dilute hydrochloric acid
b Marble chips
c Calcium chloride to dry the gas
d Wooden block
e Carbon dioxide
4 Carbon cycle
f Carbon dioxide in the air
g Photosynthesis
h Fossilization
i Combustion
j Respiration
k Decay
l Decomposers

©DIAGRAM

# Sulfur
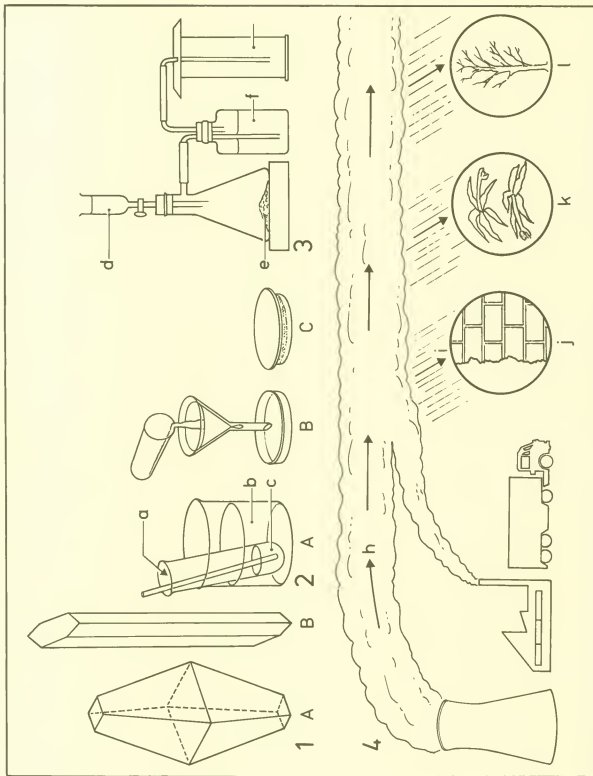
1 Crystals of sulfur
A Rhombic
B Monoclinic
2 Preparation of rhombic sulfur
A Powered sulfur is mixed with methylbenzene
a Powdered sulfur
b Warm water
c Methylbenzene
A Solution is filtered
B Solution is covered and left to crystallize
3 Preparation of sulfur dioxide
d Dilute sulfuric acid
e Sodium sulfide
f Concentrated sulfuric acid
g Sulfur dioxide
4 Acid rain
h Sulfur dioxide
i Acid rain
j Corrosion of stonework
k Dead plants
l Dying trees

© DIAGRAM

## The preparation of different gases

©DIAGRAM
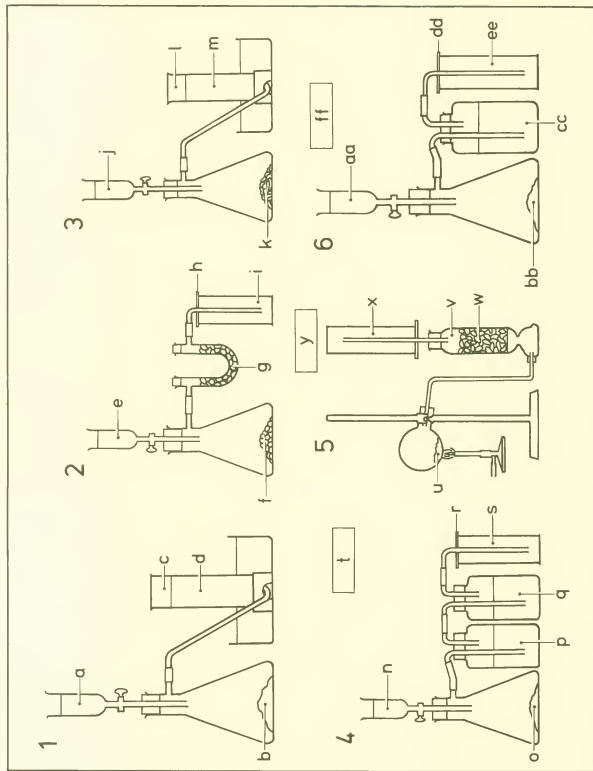
1 Oxygen
a Hydrogen peroxide
b Manganese dioxide
c Oxygen
d Water
2 Carbon dioxide
e Dilute hydrogen chloride
f Marble chips
g Calcium chloride
h Cardboard
i Carbon dioxide
3 Hydrogen
j Dilute sulfuric acid
k Zinc
l Hydrogen
m Water
4 Chlorine
n Concentrated hydrogen chloride
o Potassium permanganate
p Water
q Concentrated sulfuric acid
r Cardboard
s Chlorine
t Fume cupboard
5 Ammonia
u Ammonium chloride plus calcium hydroxide
v Drying tower
w Calcium oxide
x Ammonia
y Fume cupboard
6 Sulfur dioxide
aa Dilute sulfuric acid
bb Sodium sulfite
cc Concentrated sulfuric acid
dd Cardboard
ee Sulfur dioxide
ff Fume cupboard

## Chemical substances and formulae

| COMMON NAME | CHEMICAL NAME | FORMULA |
|---|---|---|
| Alum | Potassium aluminum sulfate | $K_2SO_4.Al_2(SO_4)_3.(H_2O)_{24}$ |
| Ammonia water | Ammonium hydroxide | $NH_4OH$ |
| Aqua fortis | Nitric acid | $HNO_3$ |
| Aqua regia | Hydrochloric and nitric acids | $3 HCl + HNO_3$ |
| Asbestos | Magnesium silicate | $Mg_3Si_2O_7.(H_2O)_2$ |
| Baking soda | Sodium hydrogen carbonate | $NaHCO_3$ |
| Bleaching powder | Calcium oxychloride | $CaOCl_2$ |
| Blue vitriol | Copper sulfate | $CuSO_4.(H_2O)_5$ |
| Borax | Sodium tetraborate | $Na_2B_4O_7.(H_2O)_{10}$ |
| Brimstone | Sulfur | $S$ |
| Brine | Table salt solution | $NaCl$ |
| Calcite | Calcium carbonate | $CaCO_3$ |
| Calomel | Mercurous chloride | $HgCl$ |
| Carbolic acid | Phenol | $C_6H_5OH$ |
| Carbonic acid gas | Carbon dioxide | $CO_2$ |
| Carborundum | Silicon carbide | $SiC$ |
| Caustic potash | Potassium hydroxide | $KOH$ |
| Caustic soda | Sodium hydroxide | $NaOH$ |
| Chalk (ppt.) | Calcium carbonate | $CaCO_3$ |
| Charcoal | Carbon (impure) | $C+$ |
| Chile saltpeter | Sodium nitrate | $NaNO_3$ |
| Coke | Carbon (impure) | $C+$ |
| Diamond | Carbon | $C$ |
| Dry ice | Carbon dioxide (solid) | $CO_2$ |
| Epsom salt | Magnesium sulfate | $MgSO_4.(H_2O)_7$ |
| Fire damp | Methane | $CH_4$ |
| Fluorspar | Calcium fluoride | $CaF_2$ |
| Galena | Lead sulfide | $PbS$ |
| Glucose | Dextrose | $C_6H_{12}O_6$ |
| Graphite | Carbon | $C$ |
| Green vitriol | Ferrous sulfate | $FeSO_4$ |
| Gypsum | Calcium sulfate | $CaSO_4.(H_2O)_2$ |
| Household ammonia | Ammonium hydroxide | $NH_4OH$ |

| COMMON NAME | CHEMICAL NAME | FORMULA |
|---|---|---|
| Iron pyrites | Iron disulfide | $FeS_2$ |
| Kaolin (clay) | Hydrogen aluminum silicate | $H_2Al_2(SiO_4)_2.H_2O$ |
| Lampblack | Carbon | $C$ |
| Laughing gas | Nitrous oxide | $N_2O$ |
| Lime, quick | Calcium oxide | $CaO$ |
| Lime, slaked | Calcium hydroxide | $Ca(OH)_2$ |
| Limestone | Calcium carbonate | $CaCO_3$ |
| Limewater | Calcium hydroxide solution | $Ca(OH)_2$ |
| Marble | Calcium carbonate | $CaCO_3$ |
| Marsh gas | Methane | $CH_4$ |
| Mothballs | Naphthalene | $C_{10}H_8$ |
| Niter (saltpeter) | Potassium nitrate | $KNO_3$ |
| Oil of vitriol | Sulfuric acid | $H_2SO_4$ |
| Pearl | Calcium carbonate | $CaCO_3$ |
| Plaster of Paris | Calcium sulfate | $(CaSO_4)_{1/2}.H_2O$ |
| Potash | Potassium carbonate | $K_2CO_3$ |
| Quartz | Silicon dioxide | $SiO_2$ |
| Quicklime | Calcium oxide | $CaO$ |
| Quicksilver | Mercury | $Hg$ |
| Sal ammoniac | Ammonium chloride | $NH_4Cl$ |
| Saltpeter | Potassium nitrate | $KNO_3$ |
| Sand | Silicon dioxide (impure) | $SiO_2$ |
| Slaked lime | Calcium hydroxide | $Ca(OH)_2$ |
| Soda, baking | Sodium hydrogen carbonate | $NaHCO_3$ |
| Soda ash | Sodium carbonate | $Na_2CO_3$ |
| Soap | Sodium stearate (mainly) | $C_{17}H_{35}COONa$ |
| Sugar | Sucrose | $C_{12}H_{22}O_{11}$ |
| Table salt | Sodium chloride | $NaCl$ |
| Vinegar | Acetic acid, dil. sol. | $HC_2H_3O_2$ |
| Water glass | Sodium silicate | $Na_2SiO_3$ |
| White lead | Lead carbonate, basic | $Pb(OH)_2.2PbCO_3$ |
| White vitriol | Zinc sulfate | $ZnSO_4$ |

## Melting and boiling points

Melting point   Boiling point

Solid   Liquid

| C° | 1000 | 2000 | 3000 | 4000 | 5000 | 6000 |
| F° | 1000 | 2000 | 3000 | 4000 | 5000 | 6000 | 7000 | 8000 | 9000 | 10000 |

© DIAGRAM
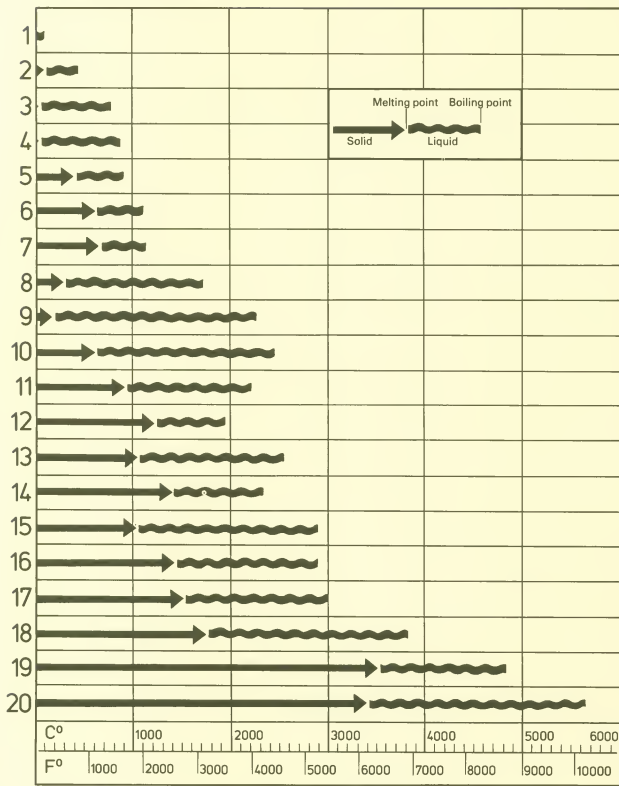
1 Water 0/100°C
2 Sulfur 113/445°C
3 Potassium 64/774°C
4 Sodium 98/883°C
5 Zinc 420/907°C
6 Magnesium 650/1110°C
7 Radium 700/1140°C
8 Lead 328/1740°C
9 Tin 232/2270°C

10 Aluminum 660/2452°C
11 Silver 962/2210°C
12 Manganese 1244/1962°C
13 Copper 1083/2566°C
14 Silicon 1412/2355°C
15 Gold 1064/2900°C
16 Nickel 1452/2900°C
17 Iron 1536/3000°C
18 Platinum 1772/3825°C

19 Carbon 3550/4825°C
20 Tungsten 3410/5660°C

## Oil production: derricks and rigs

©DIAGRAM
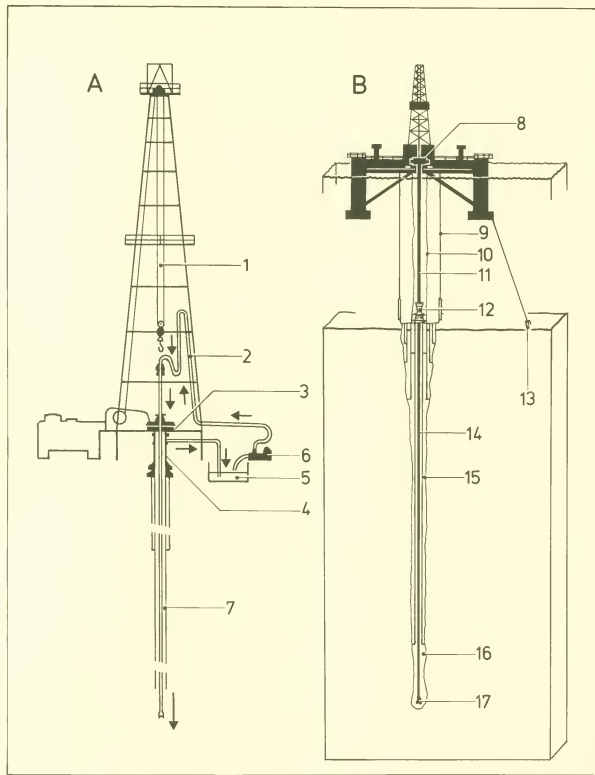
A  Drilling derrick
1  Drilling line
2  Mud hose
3  Rotary table
4  Hydraulic blow-out
   preventer
5  Mud pit
6  Mud circulation pump
7  Drill pipe

B  Exploration rig
8  Rotary table
9  Guide lines
10 Flexible control tables
11 Marine riser
12 Blow-out preventer
13 Anchor
14 Drill pipe
15 Cement

16 Mud
17 Bit

# Oil production: directional drilling
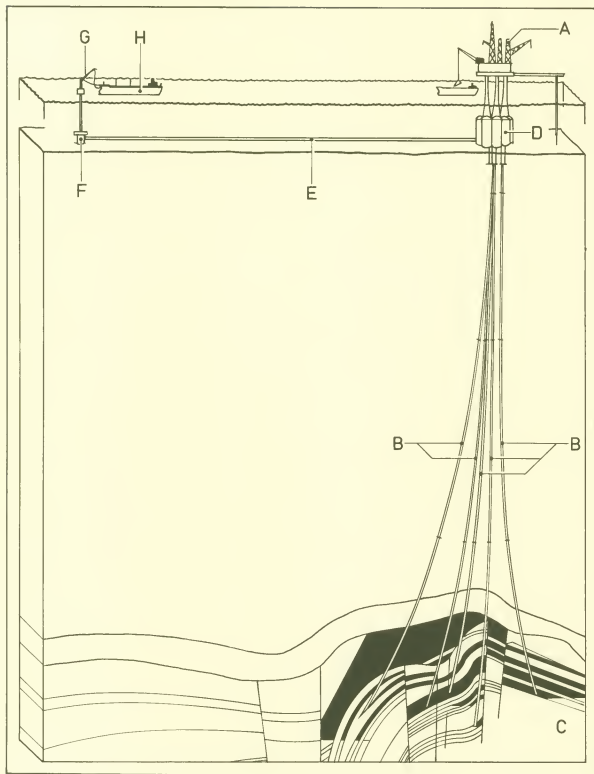
A  Platform
B  Wells
C  Oil field
D  Storage tanks
E  Pipeline
F  Mooring point
G  Loading point
H  Oil tanker

©DIAGRAM

## Oil refining
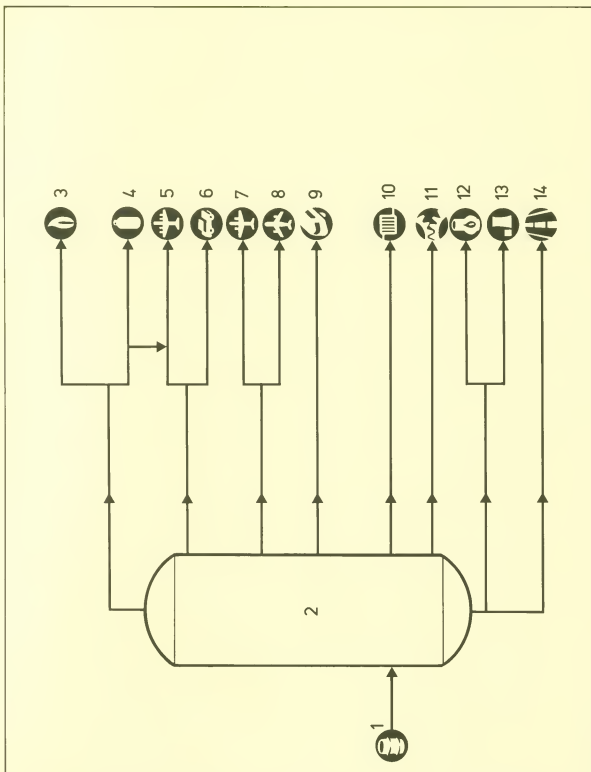
© DIAGRAM

1 Crude oil
2 Fractionating
  tower
3 Gas for chemical
  manufacture
4 Liquefied gas
5 Fuel for piston-
  engined aircraft
6 Gasoline (petrol)
7 Fuel for turbo-
  charged aircraft
8 Fuel for jet-
  engined aircraft
9 Diesel oil
10 Gas oil
11 Lubricating oil
12 Paraffin
13 Fuel oil
14 Bitumen

## Hydro-electric power production

©DIAGRAM

1 High level reservoir
2 Sluices
3 Dam
4 Control building
5 Generator
6 Turbine
7 Pump
8 Water outlets
9 Water inlets
10 Low level reservoir
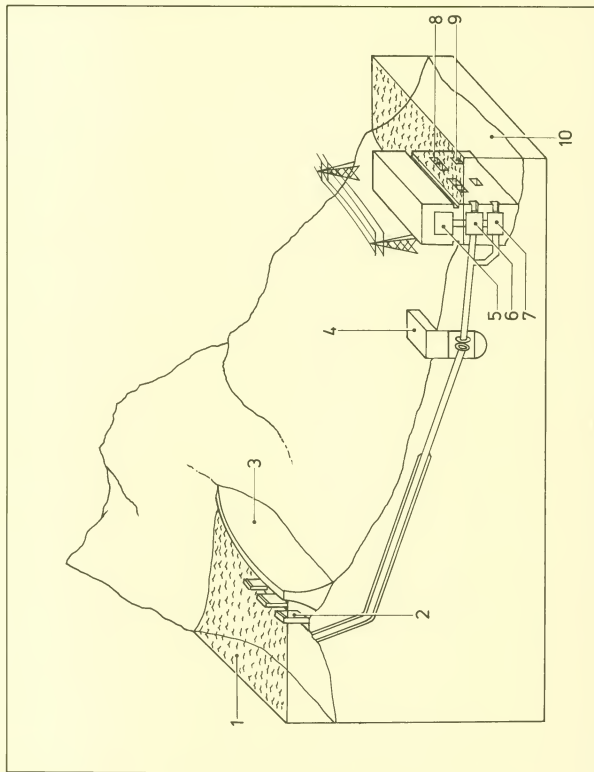
## Alternative energy sources

©DIAGRAM
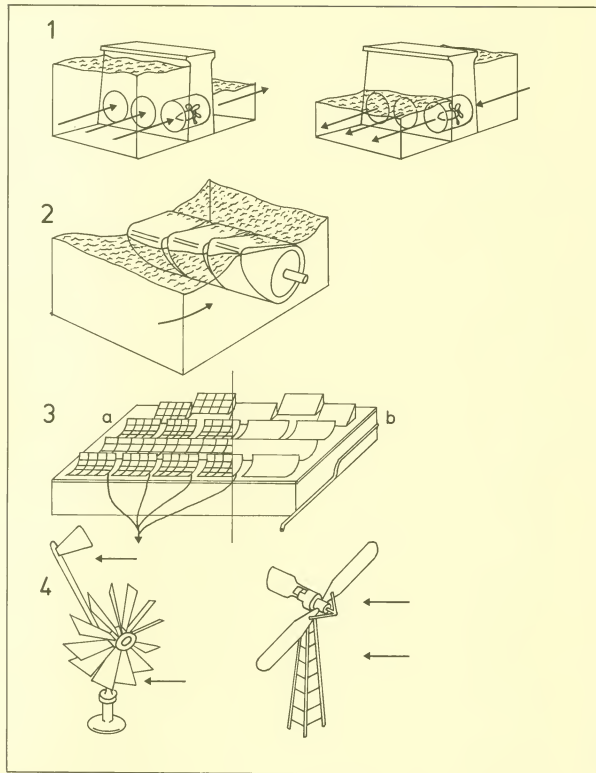
1 Tidal
2 Wave
3 Solar
a photoelectric system
b water heating system
4 Wind

## How solar energy is created
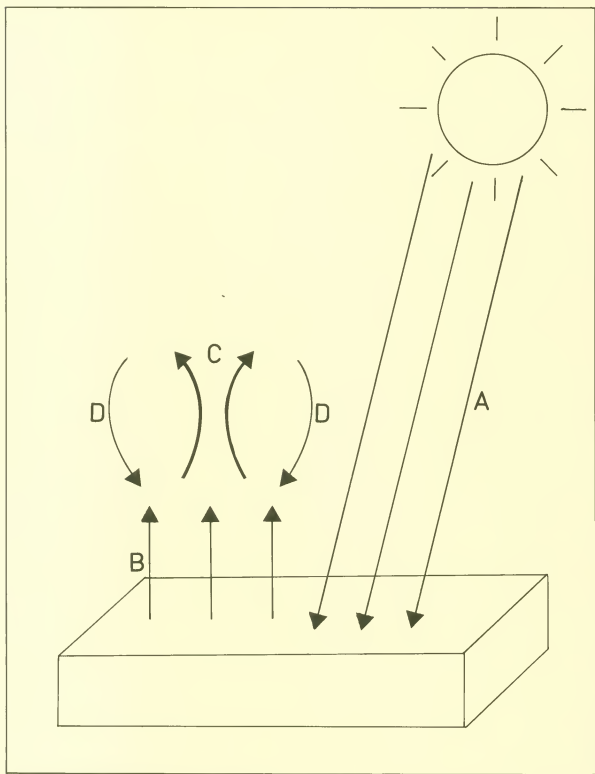
©DIAGRAM

A The sun produces radiant energy which warms the
   surface of the Earth.
B The air which is near the surface of the Earth is heated
   by conduction.
C Warm air rises.
D Cold air sinks due to convection.

## Celestial coordinates
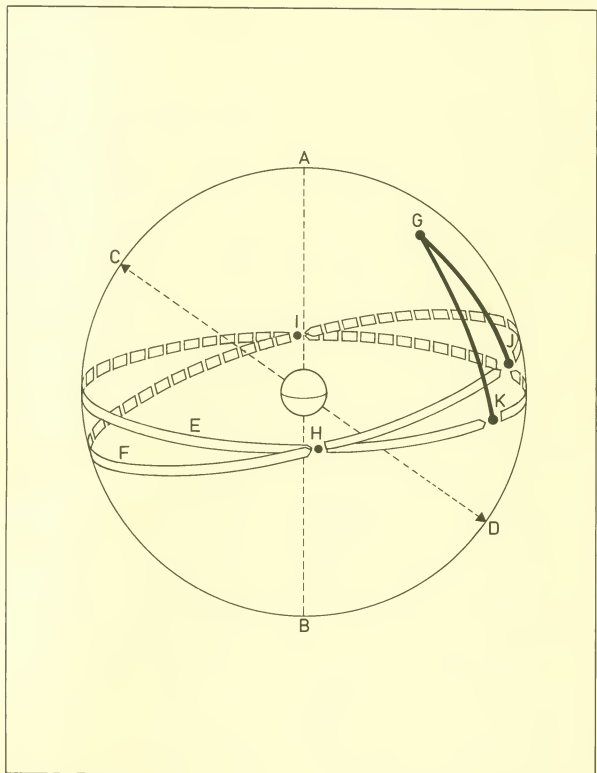
A North celestial pole
B South celestial pole
C Zenith
D Nadir
E Celestial equator
F Ecliptic
G Celestial object
H Vernal equinox – first point of Aries
I Autumnal equinox – first point of Libra
J Celestial longitude of G in degrees anticlockwise from H
K Right ascension of G in hours anticlockwise from H

## Constellations of the northern sky
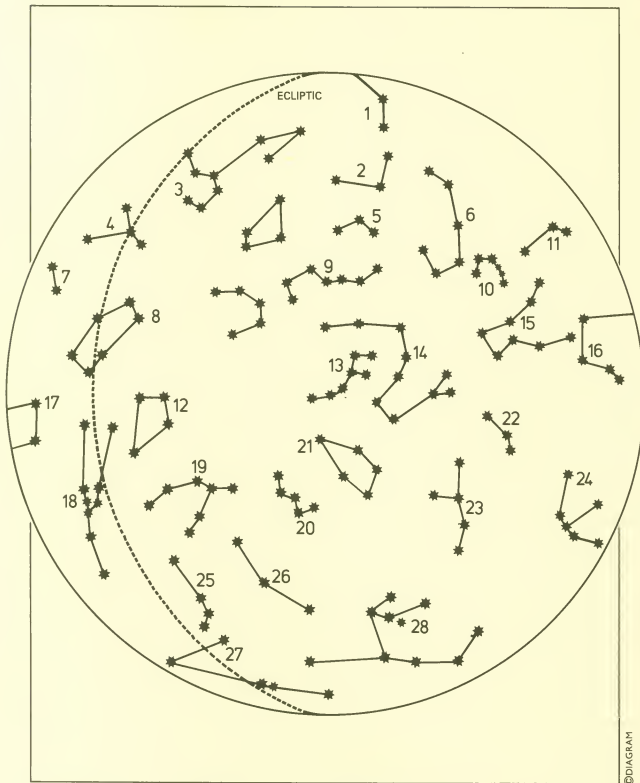
| | | |
|---|---|---|
| 1 Virgo | 11 Serpens | 21 Cephus |
| 2 Coma Berenices | 12 Auriga | 22 Lyra |
| 3 Leo | 13 Ursa Minor | 23 Cygnus |
| 4 Cancer | 14 Draco | 24 Aquila |
| 5 Canes Venatici | 15 Hercules | 25 Aries |
| 6 Bootes | 16 Ophiuchus | 26 Andromeda |
| 7 Canis Minor | 17 Orion | 27 Pisces |
| 8 Gemini | 18 Taurus | 28 Pegasus |
| 9 Ursa Major | 19 Perseus | |
| 10 Corona Borealis | 20 Cassiopeia | |

## Constellations of the southern sky

ECLIPTIC

© DIAGRAM
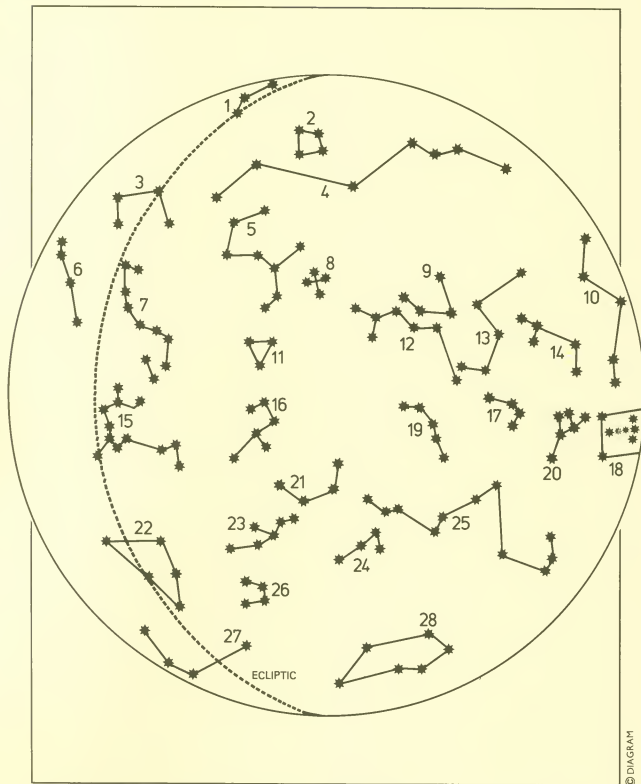
| | | |
|---|---|---|
| 1 Virgo | 11 Triangulum Australe | 21 Tucana |
| 2 Corvus | 12 Carina | 22 Capricornus |
| 3 Libra | 13 Puppis | 23 Grus |
| 4 Hydra | 14 Canis Major | 24 Phoenix |
| 5 Centaurus | 15 Sagittarius | 25 Eridanus |
| 6 Ophiuchus | 16 Pavo | 26 Piscis Austrinus |
| 7 Scorpius | 17 Columba | 27 Aquarius |
| 8 Crux | 18 Orion | 28 Cetus |
| 9 Vela | 19 Dorado | |
| 10 Monoceros | 20 Lepus | |

## Relationship of planets to the Sun

A  The distance of planets from the Sun
B  The inner planets
C  The size of the planets compared with the Sun

1  Sun
2  Mercury
3  Venus
4  Earth
5  Mars
6  Jupiter
7  Saturn
8  Uranus
9  Neptune
10  Pluto

©DIAGRAM
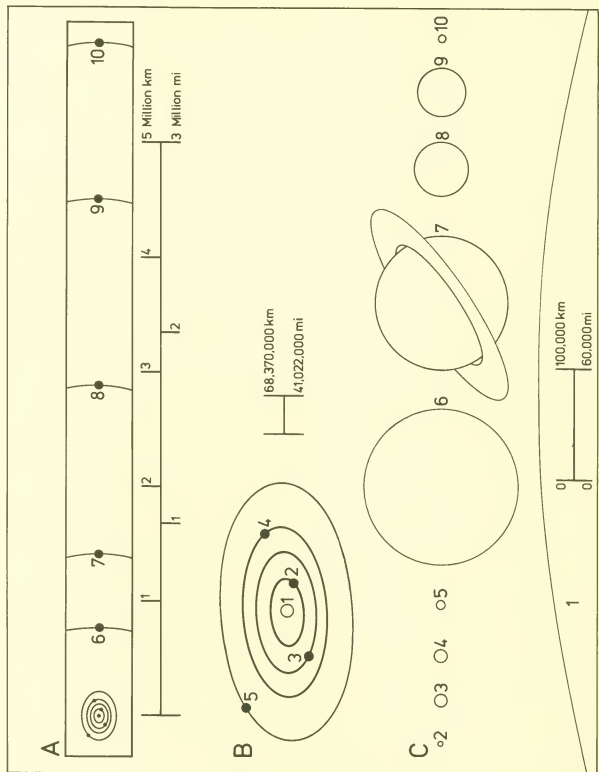
## Moons and satellites of planets

Smallest planets

A B C D E F G
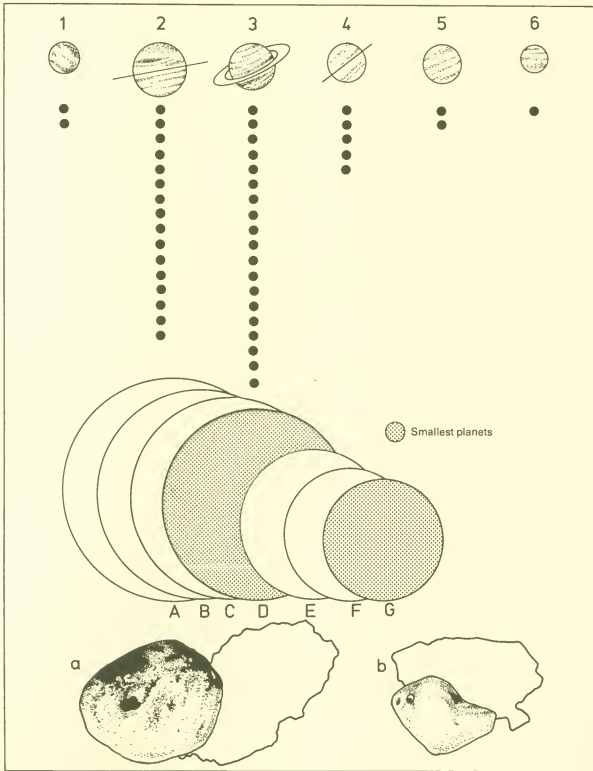
Number of satellites
orbiting the planets
1 Mars
2 Jupiter
3 Saturn
4 Uranus
5 Neptune
6 Pluto

Larger satellites and
smallest planets
A Ganymede
B Titan
C Mercury
D Callisto
E Io
F Europa
G Pluto

Small satellites
a Phobos shown to scale
 against Grenada
b Deimos shown to scale
 against Kahoolawe
 (Hawaii)

©DIAGRAM

## Comparative sizes of stars to the Sun
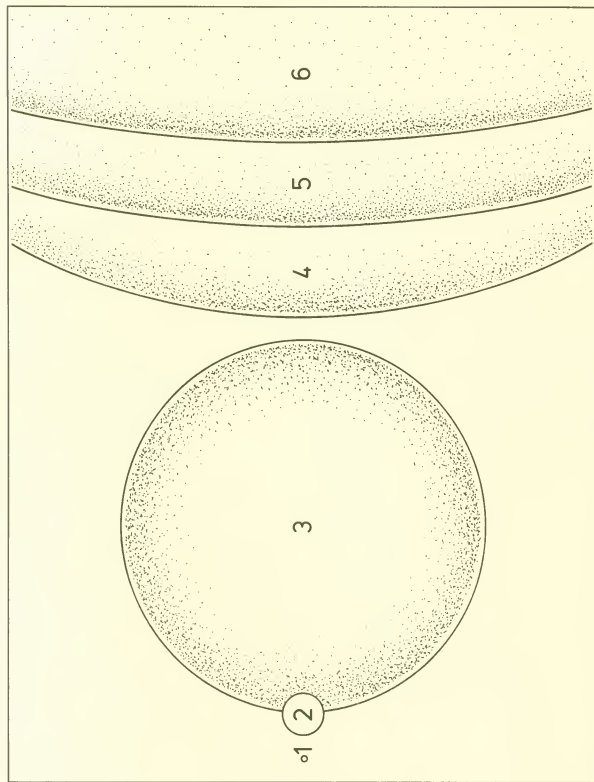
**Name**
1 Sirius B
2 Barnard's Star
3 Sun
4 Capella
5 Rigel
6 Betelgeux

**Description**
1 White dwarf
2 Red dwarf
3 Yellow dwarf
4 Yellow giant
5 Blue white giant
6 Red supergiant

**Size of diameter**
1 1/100th of Sun's
2 1/10th of Sun's
3 840,000 mi
4 16 times Sun's
5 80 times Sun's
6 300-400 times Sun's

©DIAGRAM
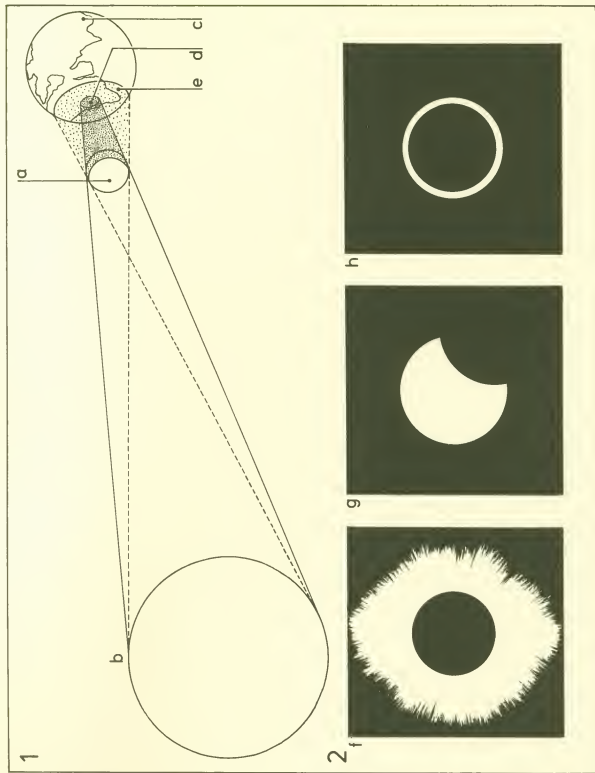
**Eclipse of the Sun**

1 If the Moon (a) lies directly between the Sun (b) and the Earth (c) the disc of the Moon appears to cover the source of light from the Sun. Whereas that part of the Earth lying directly in the shadow of the Moon (d) experiences a total eclipse of the Sun, the areas around the shadow of the Moon (e) experience a partial eclipse.

2 Types of eclipse
(f) Total – the corona of the Sun is visible to the naked eye.
(g) Partial – the disc of the Sun is only partially obscures the source of light from the Sun.
(h) Annular – the disc of the Moon appears slightly smaller than the Sun, and occurs if the Moon is at its farthest point from the Earth which is itself at its nearest point to the Sun.

## Eclipse of the Moon

A
F
B
C
D
E

©DIAGRAM

A Sun
B Earth
C Moon
D Umbra (inner complete shadow)
E Penumbra (zone of partial shadow)
F Solar radiation
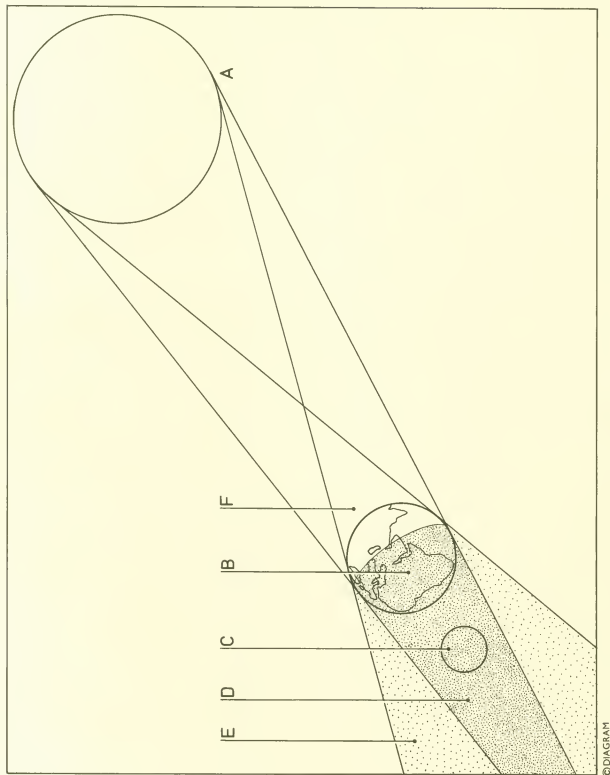
## Phases of the Moon
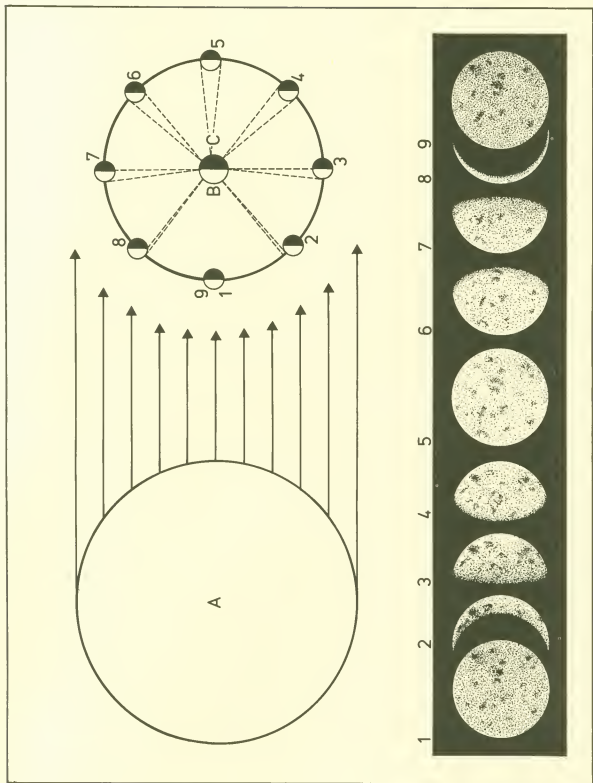
1 New Moon
2 Waxing crescent Moon
3 Half Moon, first quarter
4 Waxing gibbous Moon
5 Full Moon
6 Waning gibbous Moon
7 Half Moon, last quarter
8 Waning crescent Moon
9 New Moon

A Sun
B Day
C Night
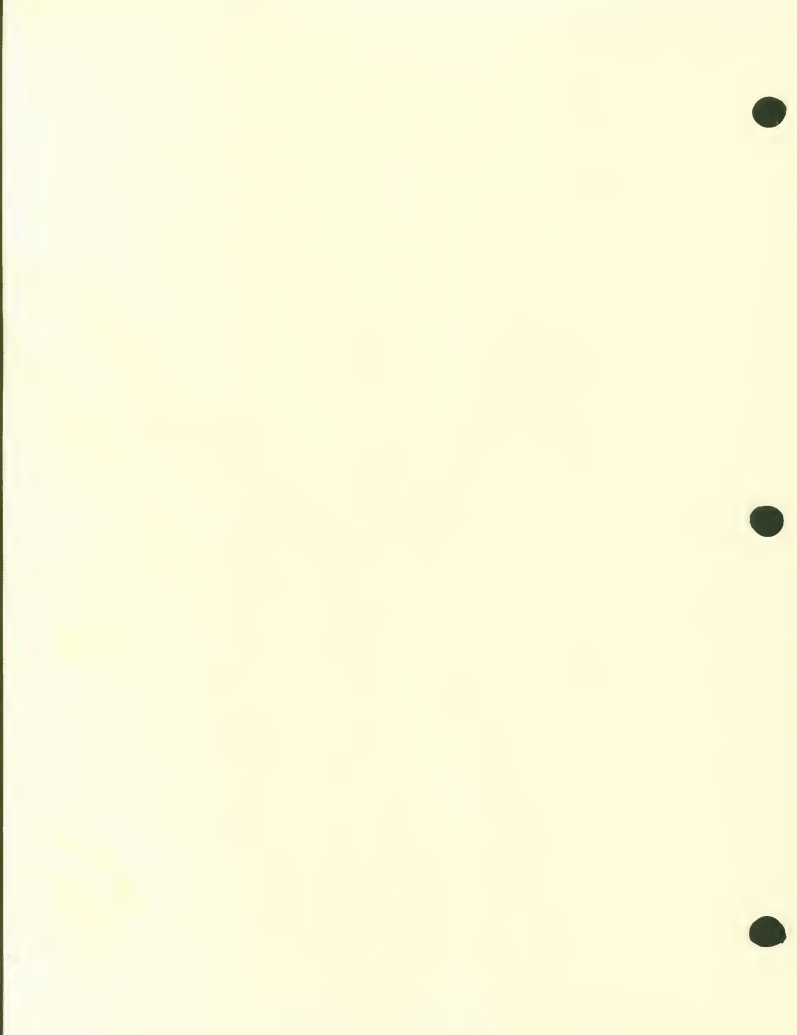
©DIAGRAM

**Classification of living organisms**

LIVING ORGANISMS
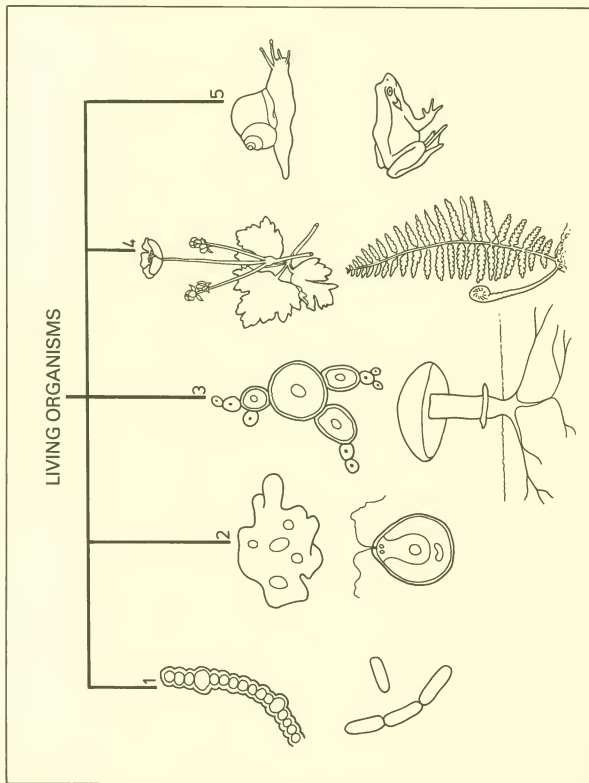
Kingdoms
1 Monera
2 Protista
3 Fungi
4 Plantae
5 Animalia

**Classification of Kingdom Monera**

KINGDOM MONERA
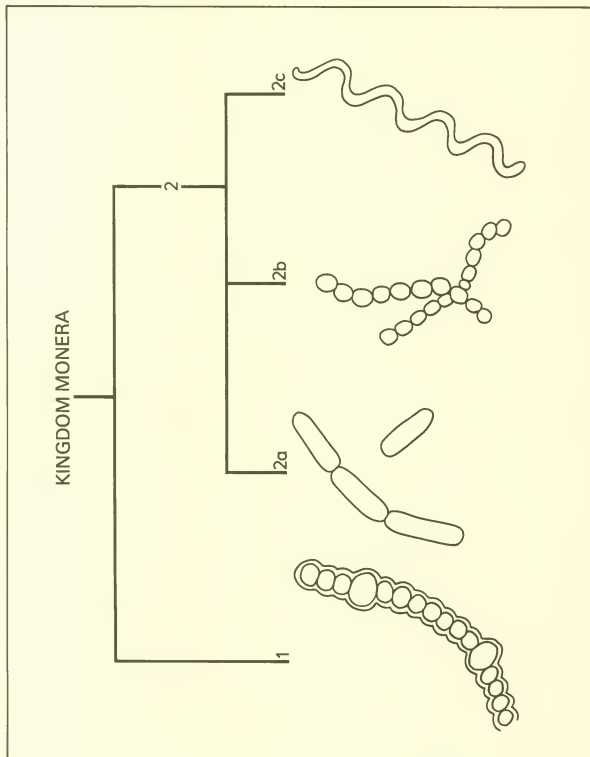
1 Phylum Cyanophyta
(blue-green algae,
eg *Nostoc*)
2 Phylum Schizophyta
(bacteria)
2a-c Bacterial shapes
2a Bacillus (rods, eg
*Bacillus anthracis*)
2b Coccus (spheres, eg
*Streptococcus*)
2c Spirillum (spirals, eg
*Treponema*)

©DIAGRAM

## Classification of Kingdom Protista
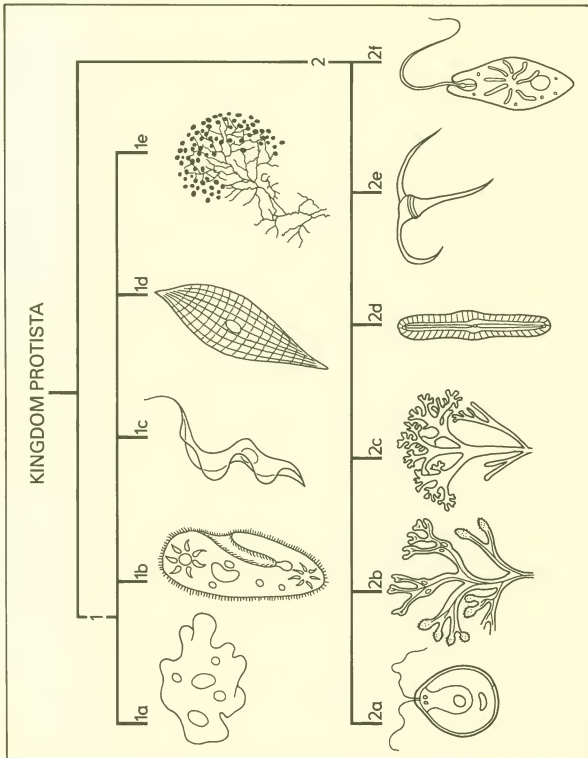
1 Heterotrophic protists
1a Phylum Sarcodina (eg *Amoeba*)
1b Phylum Ciliophora (eg *Paramecium*)
1c Phylum Mastigophora (eg *Trypanosoma*)
1d Phylum Sporozoa (eg *Monocystis*)
1e Phylum Myxomycota (eg *Physarum* in 'plant-like phase')
2 Autotrophic protists
2a Phylum Chlorophyta (eg *Chlamydomonas*)
2b Phylum Phaeophyta (eg *Fucus*)
2c Phylum Rhodophyta (eg *Chondrus*)
2d Phylum Chrysophyta (eg Diatoms)
2e Phylum Pyrrophyta (eg *Ceratium*)
2f Phylum Euglenophyta (eg *Euglena*)

© DIAGRAM

## Classification of Kingdom Fungi

**KINGDOM FUNGI**
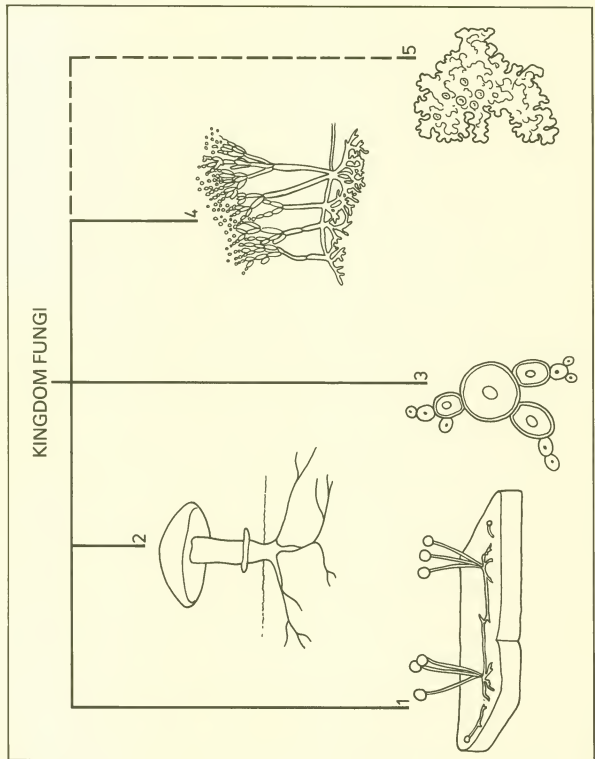
1 Phylum Zygomycota (eg
  *Rhizopus* – bread
  mold
2 Phylum Basidiomycota
  (eg *Agaricus* –
  mushroom)
3 Phylum Ascomycota (eg
  *Saccharomyces* – yeast)
4 Phylum Deuteromycota
  (eg *Penicillium*)
5 Phylum
  Mycophycophyta
  (lichens – a mutualistic
  relationship between
  fungi and algae)

©DIAGRAM

## Classification of Kingdom Plantae

KINGDOM PLANTAE
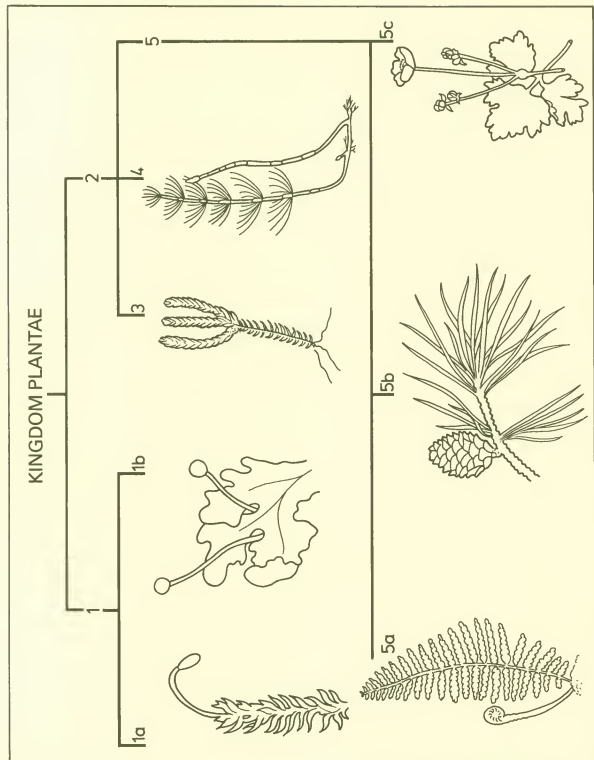
1 Phylum Bryophyta
1a Class Musci (mosses)
1b Class Hepaticae
(liverworts)
2 Phylum Tracheophyta
3 Subphylum Lycopsida
(club mosses)
4 Subphylum
Sphenopsida
(horsetails)
5 Subphylum Pteropsida
5a Class Filicinae (ferns)
5b Class Gymnospermae
(ginkgoes, cycads and
conifers)
5c Class Angiospermae
(flowering plants)

©DIAGRAM

## Numbers of plant species
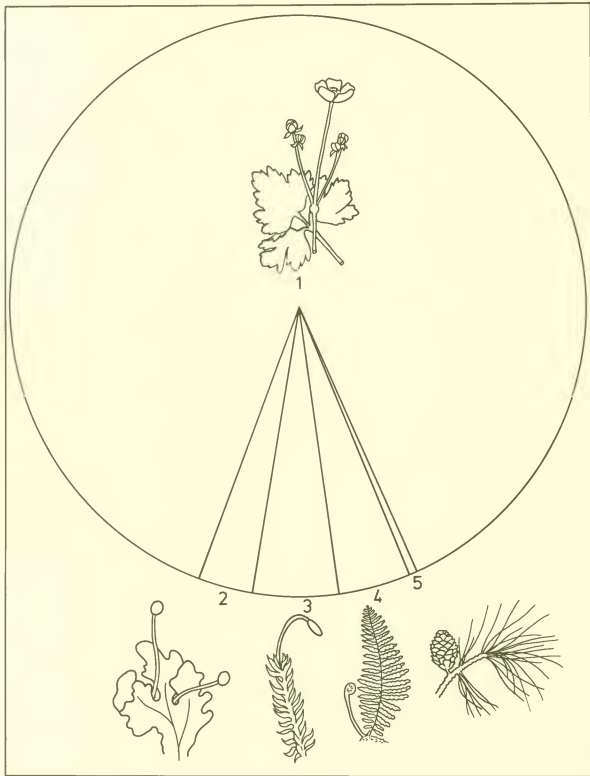
1 Flowering plants (Class Angiospermae) 250,000 species
2 Liverworts (Class Hepaticae) 9,000 species
3 Mosses (Class Musci) 14,000 species
4 Ferns (Class Filicinae) 12,000 species
5 Ginkgoes, cycads, and conifers (Class Gymnospermae) 700 species

## Some families of flowering plants

1   Monocotyledons
1a  Liliaceae (eg tulip)
1b  Gramineae (eg wheat)
1c  Araceae (eg Jack-in-the-pulpit)
1d  Palmae (eg date palm)
1e  Orchidaceae (eg orchid)
2   Dicotyledons
2a  Ranunculaceae (eg buttercup)
2b  Betulaceae (eg alder)
2c  Rosaceae (eg rose)
2d  Fabaceae (eg clover)
2e  Asteraceae (eg daisy)
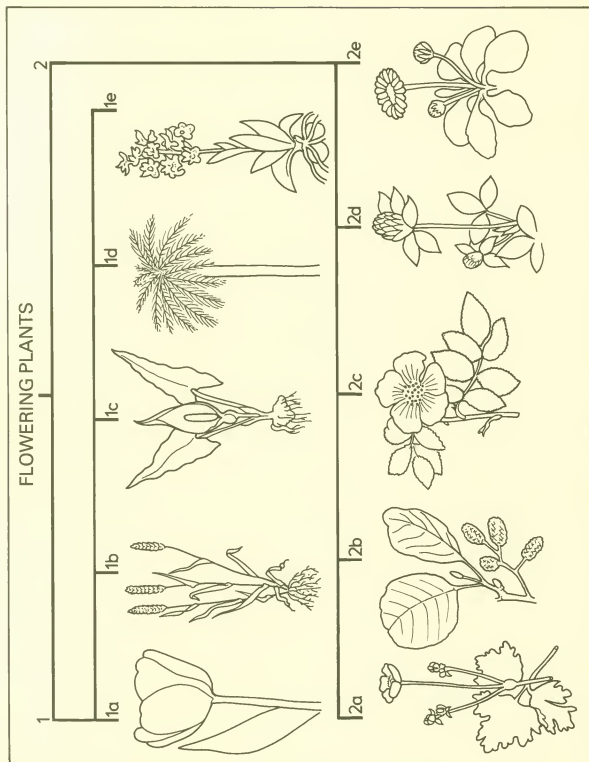
## Classification of invertebrates

INVERTEBRATES

© DIAGRAM
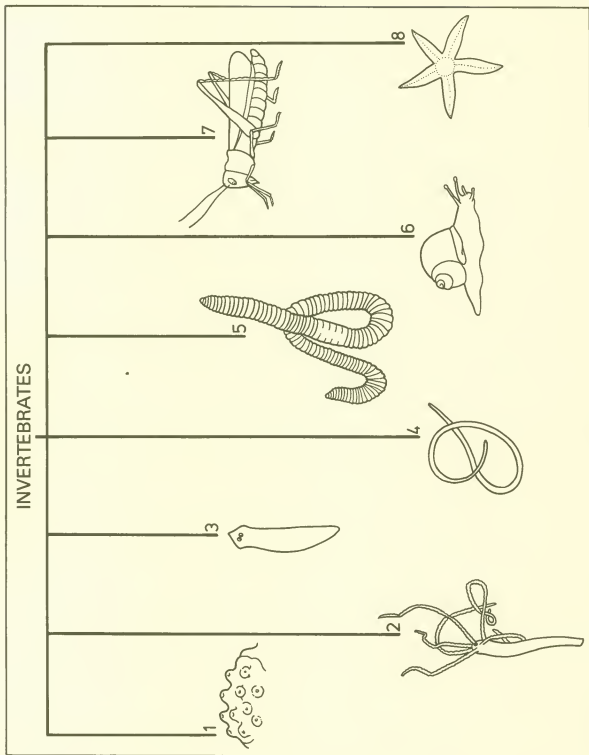
1 Phylum Porifera (eg sponges)
2 Phylum Coelenterata (eg *Hydra*)
3 Phylum Platyhelminthes (eg flatworm)
4 Phylum Nematoda (eg *Ascaris*)
5 Phylum Annelida (eg earthworm)
6 Phylum Mollusca (eg snail)
7 Phylum Arthropoda (eg grasshopper)
8 Phylum Echinodermata (eg starfish)

## Classification of chordates
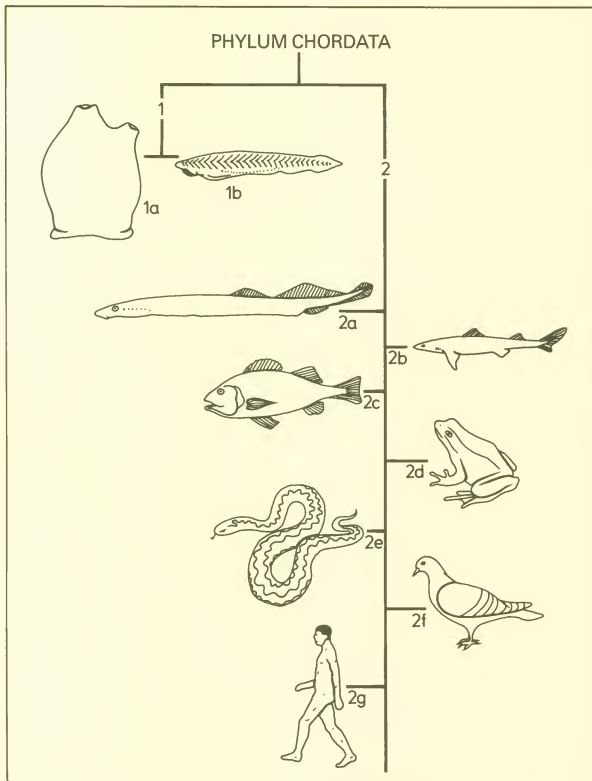
PHYLUM CHORDATA

1  Subphylum Acrania
1a Class Urochordata (sea squirts)
1b Class Cephalochordata (lancelets)
2  Subphylum Craniata (vertebrates)
2a Class Agnatha (lampreys and hagfishes)
2b Class Chondrichthyes (cartilaginous fishes)
2c Class Osteichthyes (bony fishes)
2d Class Amphibia
2e Class Reptilia

2f Class Aves (birds)
2g Class Mammalia

©DIAGRAM

## Numbers of animal species
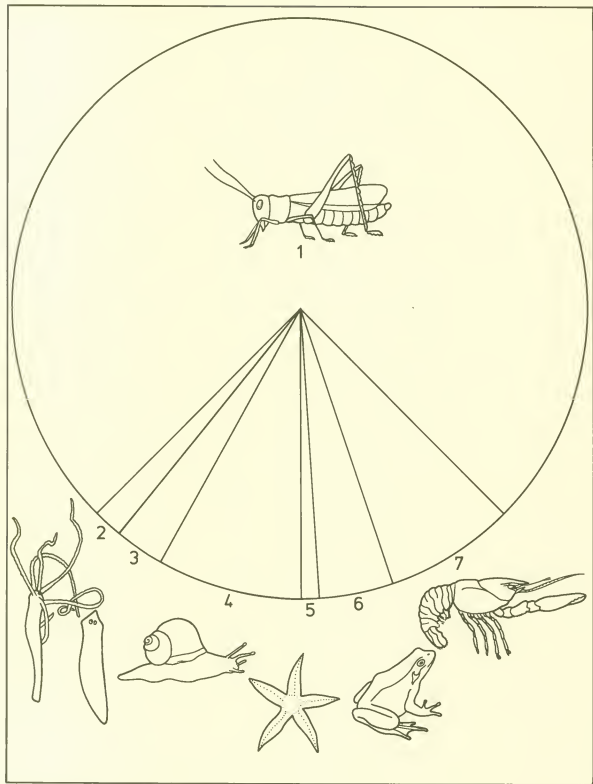
1 Insects (800,000+)
2 Sponges and coelenterates (17,000)
3 All worms (annelids, nematodes and platyhelminths)
  (25,000)
4 Mollusks (85,000)
5 Echinoderms (5,000)
6 Vertebrates (50,000)
7 Other arthropods (80,000)

© DIAGRAM

## Classification of insects
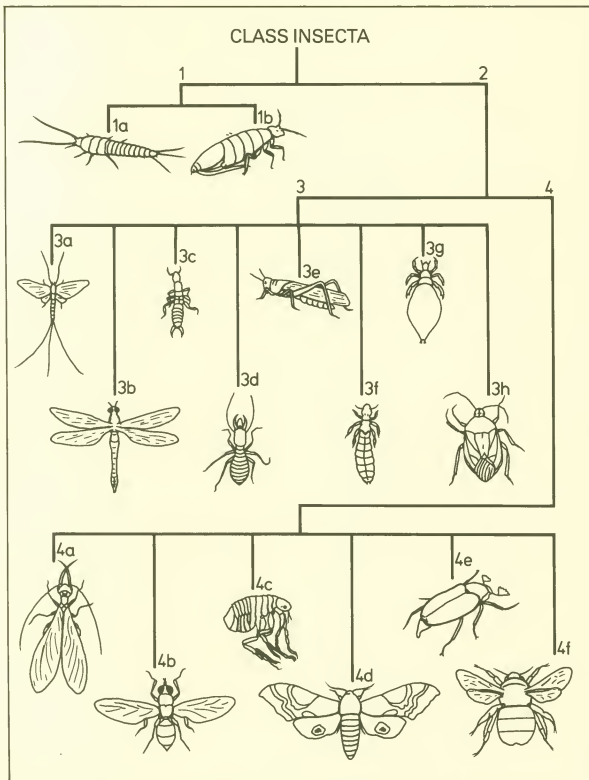
Representative orders of Class Insecta
  1 Subclass Apterygota (wingless insects)
  1a Order Thysanura (silverfish)
  1b Order Collembola (springtails)
  2 Subclass Pterygota (winged insects)
  3 Exopterygote orders (show incomplete metamorphosis)
  3a Ephemeroptera (mayflies)
  3b Odonata (dragonflies)
  3c Dermaptera (earwigs)
  3d Isoptera (termites)
  3e Orthoptera (grasshoppers)
  3f Mallophaga (biting lice)
  3g Anoplura (sucking lice)
  3h Hemiptera (true bugs)
  4 Endopterygote orders (show complete metamorphosis)
  4a Neuroptera (lacewings)
  4b Diptera (flies)
  4c Siphonaptera (fleas)
  4d Lepidoptera (butterflies)
  4e Coleoptera (beetles)
  4f Hymenoptera (bees, ants)

©DIAGRAM

## Classification of fish
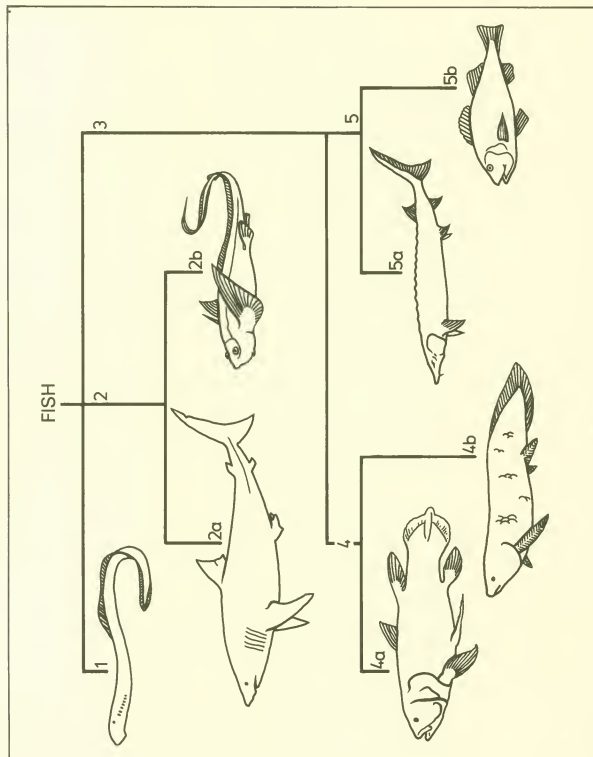
FISH

1 Class Agnatha
(lampreys and
hagfishes – jawless
fish)
2 Class Chondrichthyes
(cartilaginous fish)
2a Order Selachii (sharks,
rays)
2b Order Bradyodonti
(chimaera)
3 Class Osteichthyes
(bony fish)
4 Subclass
Crossopterygii (fleshy-
finned)
4a Order Coelacanthini
(coelacanths)
4b Order Dipnoi (lung fish)
5 Subclass Actinopterygii
(ray-finned)
5a Order Acipenseroidei
(sturgeon)
5b Order Teleostei (perch,
cod)

©DIAGRAM

## Classification of amphibia

CLASS AMPHIBIA
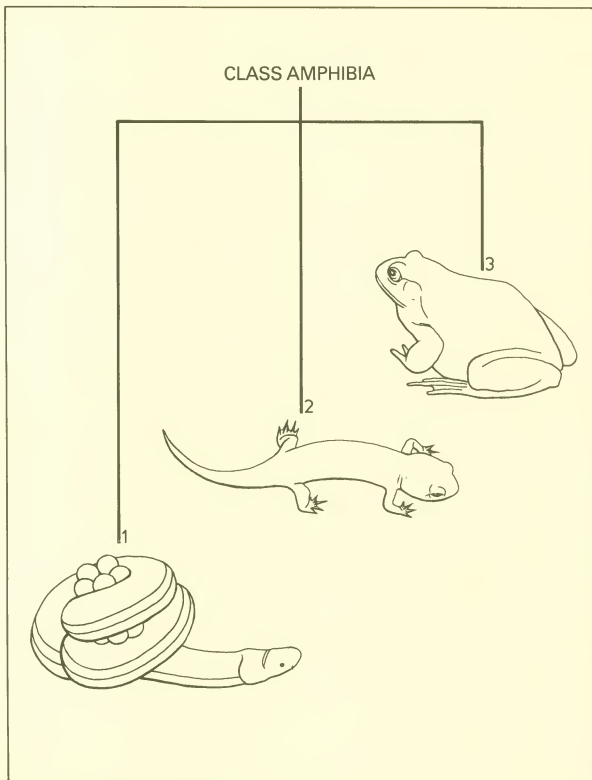
©DIAGRAM

1 Subclass Apoda (legless amphibians)
2 Subclass Urodela (tailed amphibians – salamander,
  mudpuppy)
3 Subclass Anura (tailless amphibians – frog, toad)

## Classification of reptiles

CLASS REPTILIA

Reptile orders
1 Crocodilia (crocodiles and alligators)
2 Chelonia (turtles and tortoises)
3 Squamata
3a Suborder Lacertilia (lizards)
3b Suborder Ophidia (snakes)
4 Rhynchocephalia (tuatara)
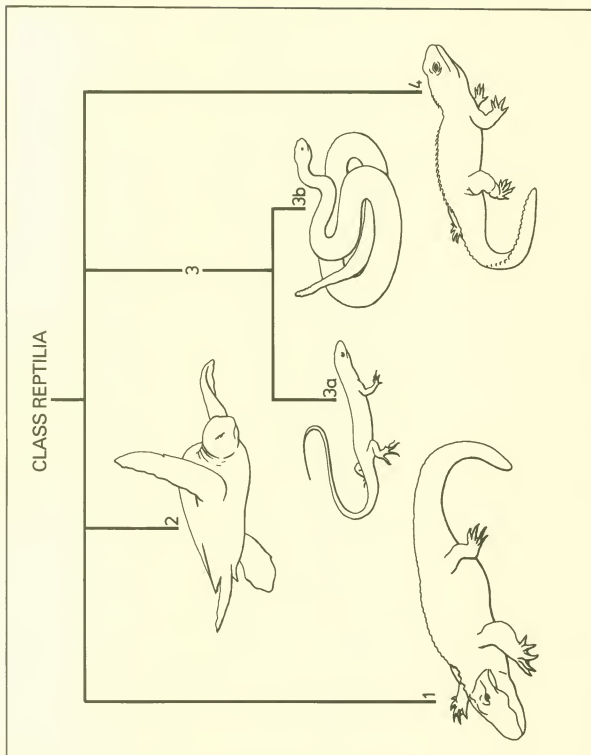
© DIAGRAM

## Classification of birds
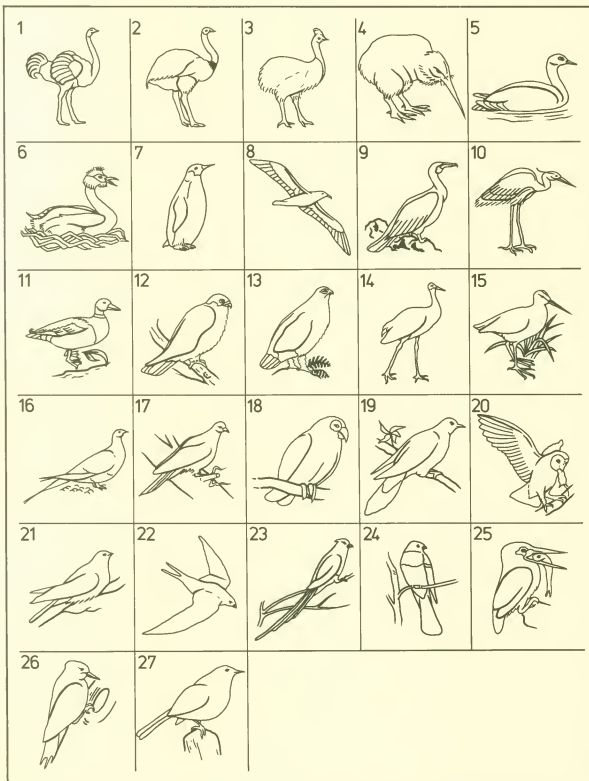
Bird orders
1 Struthioniformes (ostriches)
2 Rheiformes (rheas)
3 Casuariiformes (cassowaries)
4 Apterygiformes (kiwis)
5 Gaviiformes (loons)
6 Podicipediformes (grebes)
7 Sphenisciformes (penguins)
8 Procellariiformes (albatross, petrels)
9 Pelecaniformes (cormorants, pelicans, gannets)
10 Ciconiiformes (storks, herons)
11 Anseriformes (ducks)
12 Falconiformes (hawks)
13 Galliformes (game birds)
14 Gruiformes (rails, cranes)
15 Charadriiformes (gulls, waders)
16 Pteroclidiformes (sand grouse)
17 Columbiformes (pigeons)
18 Psittaciformes (parrots)
19 Cuculiformes (cuckoos)
20 Strigiformes (owls)
21 Caprimulgiformes (nightjars)
22 Apodiformes (swifts)
23 Coliiformes (mousebirds)
24 Trogoniformes (trogons)
25 Coraciiformes (kingfishers)
26 Piciformes (woodpeckers)
27 Passeriformes (thrushes, sparrows)

©DIAGRAM

## Classification of mammals

**CLASS MAMMALIA**
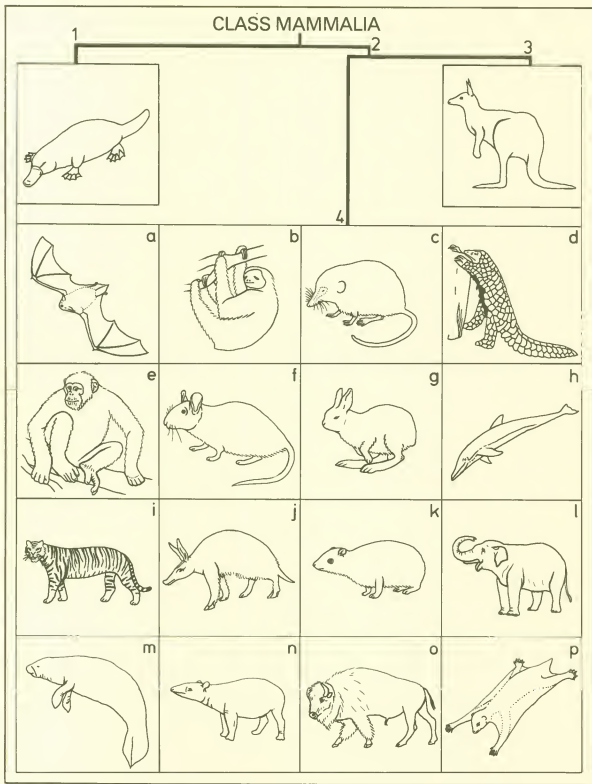
**1** Subclass
Prototheria
(monotremes)

**2** Subclass Theria

**3** Infraclass
Metatheria
(marsupials)

**4** Infraclass Eutheria
(placentals)

**4a-4p** Eutherian orders

**4a** Chiroptera (bats)
**4b** Edentata (sloths,
armadillos,
anteaters)
**4c** Insectivora (moles,
shrews)
**4d** Pholidota
(pangolins)
**4e** Primates (monkeys,
apes)

**4f** Rodentia (rats,
mice)
**4g** Lagomorpha
(rabbits, hares)
**4h** Cetacea (dolphins,
whales)
**4i** Carnivora (cats, wolves)
**4j** Tubulidentata
(aardvarks)
**4k** Hyracoidea (hyrax)

**4l** Proboscidea
(elephants)
**4m** Sirenia (sea cows)
**4n** Perissodactyla
(tapirs, horses,
rhinos)
**4o** Artiodactyla (pigs,
cattle, camels)
**4p** Dermoptera (flying
lemurs)

©DIAGRAM

## Characteristics of plants
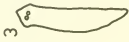
| COMMON NAME | EXTERNAL APPEARANCE | VASCULAR TISSUE | STRUCTURE | HABITAT |
|---|---|---|---|---|
| **1** Mosses/Liverworts | | Absent | Multicellular; no true roots, stems of leaves | Moist areas on land |
| **2a** Club mosses/ Horsetails | | Present | Multicellular; true roots, stems and leaves | Moist areas on land |
| **2b** Ferns | | Present | Multicellular; true roots, stems and leaves, develop from rhizome | Moist areas on land |
| **2c** Conifers | | Present | Multicellular; true roots, stems and leaves | Land |
| **2d** Flowering plants (Monocots and dicots) | | Present | Multicellular; true roots, stems and leaves | Land |

1 Phylum Bryophyta
2 Phylum Tracheophyta
2a Subphyla Lycopsida and Sphenosida
2b Subphylum Pteropsida Class Filicinae
2c Subphylum Pteropsida Class Gymnospermae
2d Subphylum Pteropsida Class Angiospermae

©DIAGRAM

## Characteristics of invertebrates

| | Sponges | Coelenterates | Flatworms | Roundworms | Segmented worms | Mollusks |
|---|---|---|---|---|---|---|
| COMMON NAME | | | | | | |
| EXTERNAL APPEARANCE | | | | | | |
| LOCOMOTION | None | Mostly sessile; free floating | Muscles; cilia | Muscles | Muscles | Muscles |
| SYMMETRY | None or radial | Radial | Bilateral | Bilateral | Bilateral | Bilateral |
| NUMBER OF BODY OPENINGS | One | One | One | Two | Two | Two |
| NUMBER OF CELL LAYERS | Two | Two | Three | Three | Three | Three |
| NERVOUS SYSTEM | None | Present | Present | Present | Present | Present |
| DIGESTIVE SYSTEM | None | Present | Present | Present | Present | Present |
| EXCRETORY SYSTEM | None | None | Present | Present | Present | Present |
| CIRCULATORY SYSTEM | None | None | None | None | Present | Present |
| RESPIRATORY SYSTEM | None | None | None | None | None | Present |
| SKELETAL SYSTEM | Spicules, no true system | None | None | None | None | Hard outer shell |

©DIAGRAM

Phyla
1 Porifera
2 Coelenterata
3 Platyhelminthes
4 Nematoda
5 Annelida
6 Mollusca

## Characteristics of arthropods

| CLASS | EXTERNAL APPEARANCE | BODY SECTIONS | ANTENNAE | MOUTHPARTS | NUMBER OF WALKING LEGS | GAS EXCHANGE |
|---|---|---|---|---|---|---|
| Chilopoda |  1 | Head and body segments | 1 pair | Mandibles | 1 pair per segment | Tracheae |
| Diplopoda |  2 | Head and body segments | 1 pair | Mandibles | 2 pairs per segment | Tracheae |
| Crustacea |  3 | Cephalothorax and abdomen | 2 pairs | Mandibles | 5 pairs in most forms | Gills |
| Insecta |  4 | Head, thorax and abdomen | 1 pair | Mandibles | 3 pairs | Tracheae |
| Arachnida |  5 | Cephalothorax and abdomen | None | Chelicerae | 4 pairs | Tracheae; book lungs |

©DIAGRAM

1 Centipedes
2 Millipedes
3 Crabs, lobsters, water fleas
4 Grasshoppers, butterflies, fleas
5 Scorpions, ticks, spiders

## Characteristics of vertebrates

| CLASS | EXTERNAL APPEARANCE | INTEGUMENT | BODY TEMPERATURE | LIMB STRUCTURE | GAS EXCHANGE | FERTILIZATION |
|---|---|---|---|---|---|---|
| 1 Agnatha | | Slimy skin | Ectotherm | No paired limbs | Gills | External |
| 2 Chondrichthyes | | Scales | Ectotherm | 2 pairs of fins | Gills | Internal |
| 3 Osteichthyes | | Scales and slimy skin | Ectotherm | 2 pairs of fins | Gills | External |
| 4 Amphibia | | Slimy skin in most forms | Ectotherm | 2 pairs of legs, no claws | Gills; lungs | External |
| 5 Reptilia | | Dry, scaly | Ectotherm | 2 pairs of legs, claws | Lungs | Internal |
| 6 Aves | | Feathers, scales on legs | Endotherm | 1 pair of wings, 1 pair of legs, claws | Lungs | Internal |
| 7 Mammalia | | Hair | Endotherm | 2 pairs of legs, claws in most forms | Lungs | Internal |

1 Jawless fish (lampreys, hagfish)
2 Cartilaginous fish (sharks, rays)
3 Bony fish (cod, perch)
4 Amphibians (frogs, salamanders)
5 Reptiles (lizards, crocodiles, turtles)
6 Birds
7 Mammals

©DIAGRAM

## Life processes
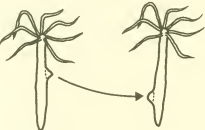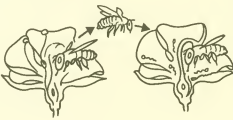
A Movement
B Feeding
C Respiration
D Reproduction
E Growth
F Excretion
G Sensitivity

©DIAGRAM

## Asexual and sexual reproduction

| | ASEXUAL | SEXUAL |
|---|---|---|
| A | | None |
| B | | |
| C | | |
| D | None | |
| E | | |

A *Ameba*
B *Paramecium*
C *Hydra*
D Frog
E Flowering plant

© DIAGRAM

## Ova and spermatozoa
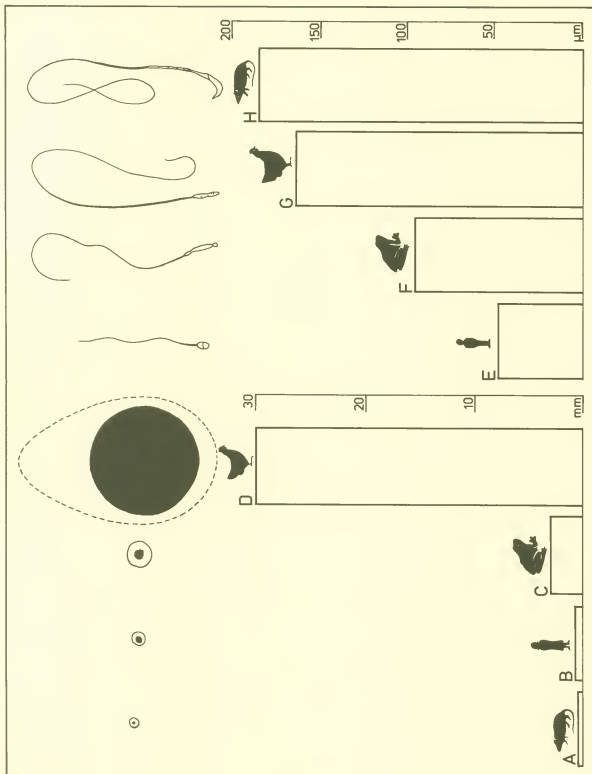
A-D Ovum diameter
A Rat 0.07mm
B Human 0.15mm
C Frog 3mm
D Chicken 30mm
E-H Spermatozoa length
E Human 53μm
F Frog 100μm
G Chicken 170μm
H Rat 189μm

©DIAGRAM

## Metamorphosis: 1 Insects (complete)
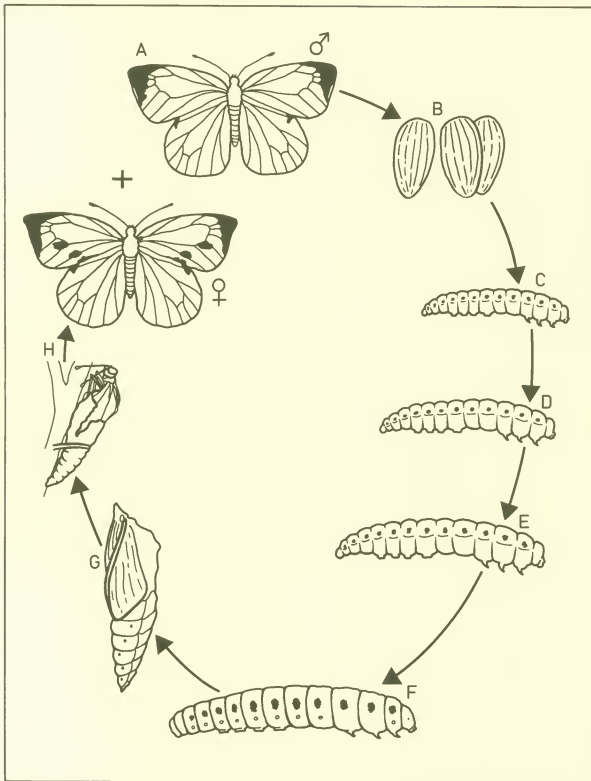
Metamorphosis in the butterfly

**A** Adults (imagos) live for 3 weeks feeding on nectar. ♂ attracted to ♀, copulates; eggs laid on leaves.

**B** Eggs (hatch after 1 week)

**C-F** Larval stages. Egg hatches to produce larva (caterpillar) which feeds on vegetation. Molts four times (ecdysis); then becomes pupa (4 weeks after hatching).

**G** Pupa (chrysalis). Cells reorganize to form adult and pupa splits open (7 weeks after hatching).

**H** Pupal cuticle splits and adult emerges.

©DIAGRAM

**Metamorphosis: 2 Insects (incomplete)**
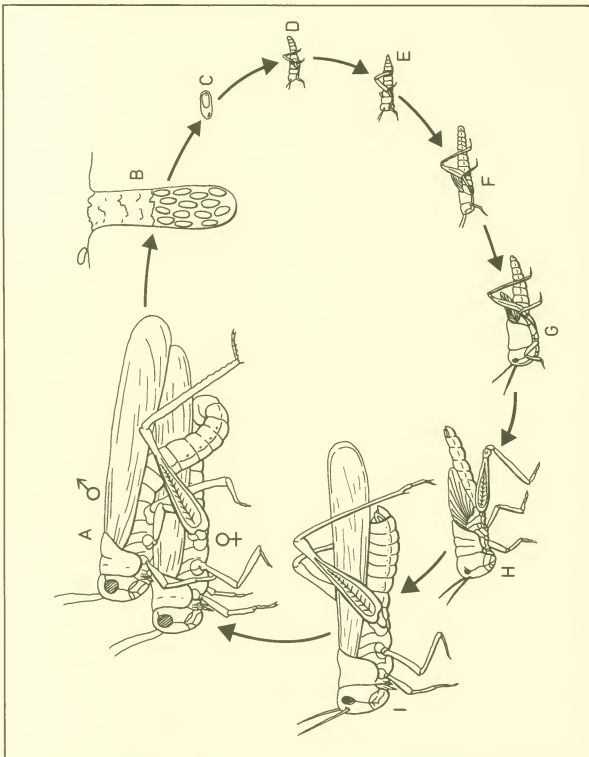
Metamorphosis in the
locust
A Mating and egg
laying. Fertilized eggs
are buried in damp
sand.
B Eggs remain in sand
for 2 weeks, then
hatch.
C Egg (6mm)
D-H Hopper stages
D 1st instar (9mm)
molts after 5 days
E 2nd instar (12mm)
molts after 4 days
F 3rd instar (19mm)
molts after 4 days
G 4th instar (23mm)
molts after 5 days
H 5th instar (32mm)
molts after 8 days
I Adult (imago) (50mm)
can fly and is sexually
mature

©DIAGRAM

## Metamorphosis: 3 Amphibians
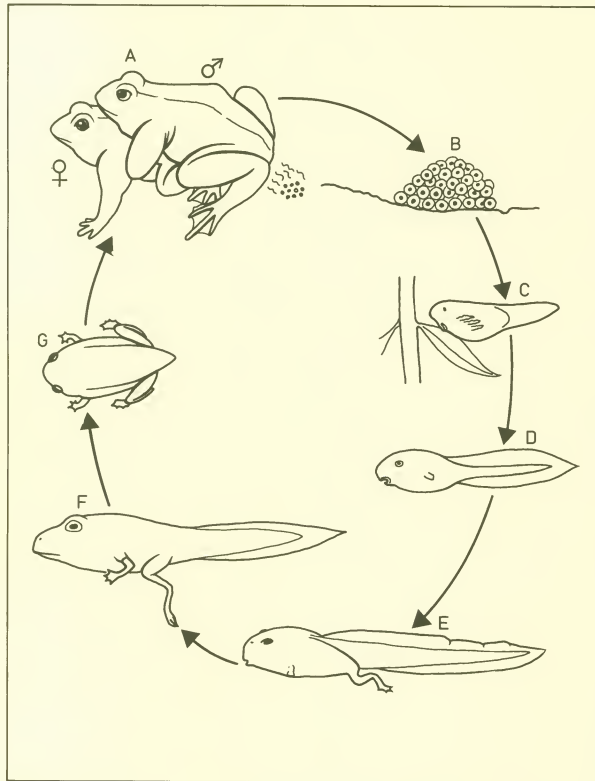
Metamorphosis in the frog
- **A** Adult frogs copulating
- **B** Egg albumen swells in water (20 minutes)
- **C** Mouthless larva with external gills attached to weed (2 days)
- **D** Herbivorous with internal gills (3 weeks)
- **E** Hind legs fully formed (8 weeks)
- **F** Metamorphosing larva, carnivorous, large eyes and mouth (12 weeks)
- **G** Frog ready to go on land (15 weeks)

©DIAGRAM

## Body systems
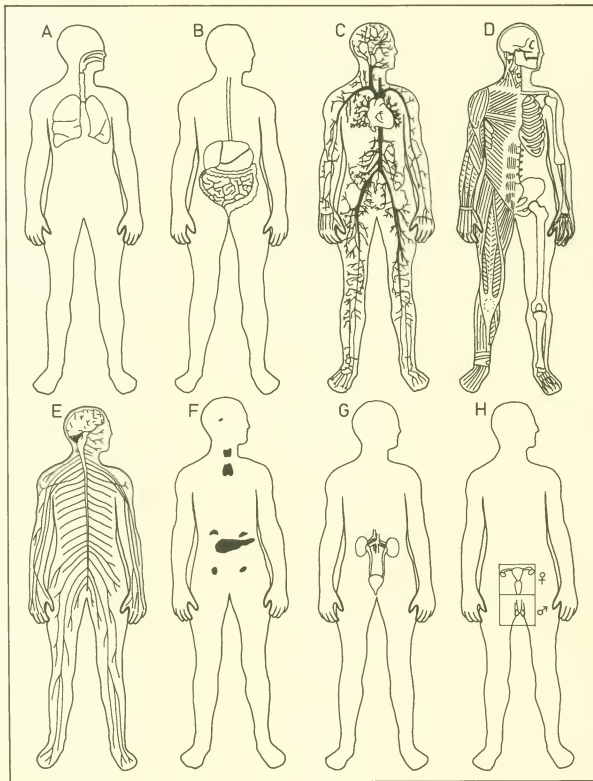
A  Respiratory (breathing)
B  Digestive
C  Transport (circulatory)
D  Locomotory (movement)
E  Nervous
F  Endocrine (hormonal)
G  Excretory
H  Reproductive

©DIAGRAM

## Digestive system in humans

| PART | FUNCTION | SECRETION | SUBSTANCE ACTED ON | PRODUCTS OF ACTION |
|------|----------|-----------|--------------------|--------------------|
| A | Saliva secretion | 1 | Starch | Maltose |
| B | Mechanical digestion | | | |
| C | Carry food to stomach | | | |
| D | Food storage and protein breakdown | 2 | Pepsinogen | Pepsin |
| | | 3 | Proteins | Polypeptides |
| E | Bile production and transport | 4 | Large fat droplets | Small fat droplets |
| F | Pancreatic juice production | 5 | Starch | Maltose |
| | | 6 | Fats | Fatty acids * and glycerol |
| | | 7 | Proteins | Polypeptides |
| G | Digestion and absorption | 8 | Starch | Maltose |
| | | 9 | Polypeptides | Amino acids * |
| | | 10 | Disaccharides | Monosaccharides * |
| | | 11 | Fats | Fatty acids * and glycerol |
| H | Absorption of water and salts | | | |
| I | Egestion of feces | | | |

* indicates a molecule small enough to be absorbed



A-I Parts of the digestive system
A  Salivary glands
B  Mouth and teeth
C  Esophagus
D  Stomach
E  Liver
F  Pancreas
G  Small intestine
H  Large intestine
I  Anus
1-11 Major secretions
 1  Salivary amylase
 2  Hydrochloric acid
 3  Pepsinogen (pepsin)
 4  Bile salts
 5  Pancreatic amylase
 6  Lipase
 7  Trypsinogen (trypsin)
 8  Amylase
 9  Peptidase
10  Carbohydrase
11  Lipase
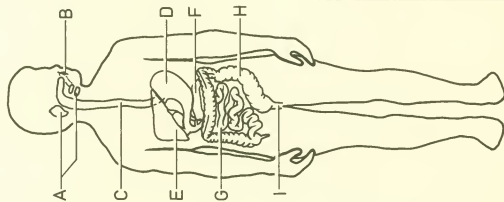
©DIAGRAM

# Endocrine system in humans

03.029

| GLAND | HORMONE | FUNCTION |
|---|---|---|
| A | 1 | Controls growth |
| | 2 | Stimulates thyroid gland |
| | 3 | Stimulates adrenal cortex hormone formation |
| | 4 | Stimulates mammary glands to produce milk |
| | 5 | Stimulates ovaries (♀) and testes (♂) |
| B | 6 | Stimulates melanin production in skin |
| C | 7 | Causes contraction of uterus during birth |
| | 8 | Controls water reabsorption by kidney |
| D | 9 | Causes calcium to be released from bones |
| E | 10 | Controls metabolic rate |
| | 11 | Causes calcium to be deposited in bones |
| F | 12 | Related to T-cell and antibody formation |
| G | 13,14 | Stimulates formation of carbohydrates from protein |
| | 15 | Regulates salt levels |
| H | 16 | Prepares body for 'flight or fight' |
| | 17 | Maintains high blood pressure and vasodilation |
| I | 18 | Reduces blood glucose level |
| J | 19 | Increases blood glucose level |
| K | 20,21 | Secondary sexual features and menstrual cycle |
| L | 22 | Secondary sexual features and sperm formation |

Body diagram labels: A,B,C  D,E,F  G,H  I,J  K  L

Endocrine glands
A-C Pituitary
  A Anterior lobe
  B Midlobe
  C Posterior lobe
D Parathyroid
E Thyroid
F Thymus
G-H Adrenal
  G Cortex
  H Medulla
I-J Pancreas
  I β-cells
  J α-cells
K Ovary (♀)
L Testes (♂)

Hormones
1 Growth
2 Thyroid-stimulating (TSH)
3 Adrenal cortex-stimulating (ACTH)
4 Prolactin
5 Gonadotrophic (FSH), luteinizing (LH)
6 Melanocyte-stimulating (MSH)
7 Oxytocin
8 Antidiuretic (ADH)
9 Parathormone
10 Thyroxine
11 Calcitonin
12 Thymosin
13 Corticosterone
14 Hydrocortisone
15 Aldosterone
16 Epinephrine
17 Norepinephrine
18 Insulin
19 Glucagon
20 Estrogens
21 Progesterone
22 Testosterone
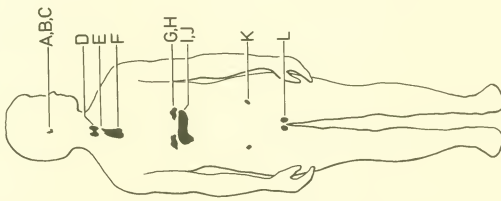
©DIAGRAM

# Respiratory systems in animals
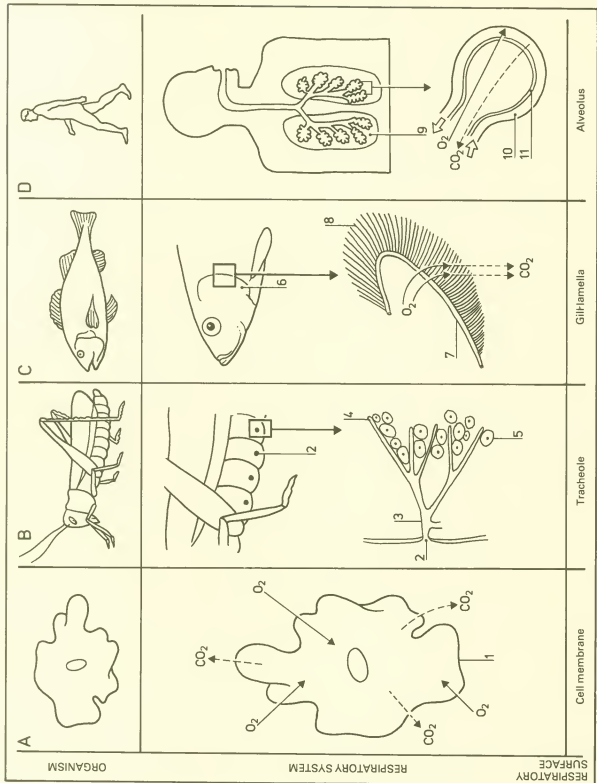
A Ameba
B Grasshopper
C Fish
D Human
1 Cell membrane
2 Spiracle
3 Trachea
4 Tracheole
5 Cell
6 Operculum
7 Gill bar
8 Gill lamella
9 Lung
10 Blood capillary
11 Alveolus
⇧ = Blood flow

©DIAGRAM

## Transport systems

OPEN SYSTEMS
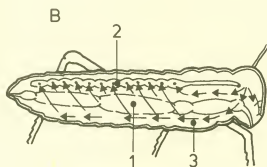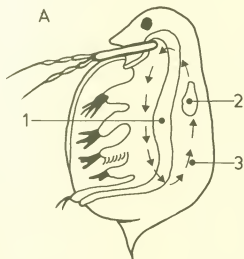
CLOSED SYSTEMS
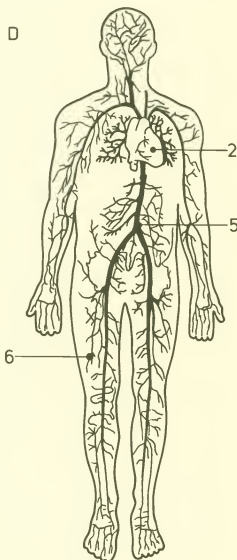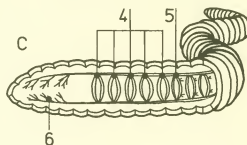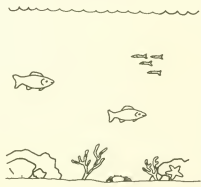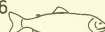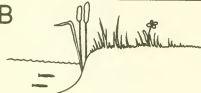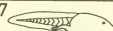
A Crustacean (water flea)
B Insect (grasshopper)
C Annelid (earthworm)
D Mammal (human)

1 Gut
2 Heart
3 Blood space
4 Hearts
5 Main blood vessel
6 Peripheral vessels

©DIAGRAM

## Nitrogenous excretion

| ENVIRONMENT | ORGANISM | MAJOR NITROGENOUS EXCRETORY PRODUCT | | |
| --- | --- | --- | --- | --- |
| | | AMMONIA | UREA | URIC ACID |
| A | 1  | ● | | |
| | 2  | ● | | |
| | 3  | ● | | |
| | 4  | ● | | |
| | 5  | ● | | |
| | 6  | ● | | |
| B | 7  | ● | | |
| | 8  | | ● | |
| C | 9  | | | ● |
| | 10  | | | ● |
| | 11  | | | ● |
| | 12  | | ● | |

Decreasing toxicity ⟶

©DIAGRAM

A Aquatic
B Aquatic changing to terrestrial
C Terrestrial

1 *Ameba*
2 *Hydra*
3 *Planaria*
4 Aquatic insect
5 Squid
6 Freshwater fish
7 Frog (tadpole)
8 Frog (adult)
9 Terrestrial insect
10 Python
11 Bird
12 Mammal (human)

## Seeing systems
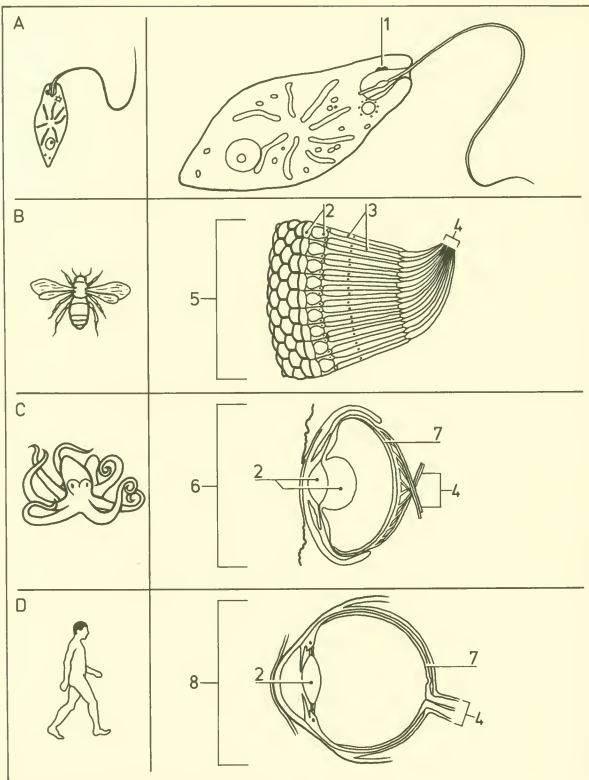
Light detection systems in four organisms
  A *Euglena* (pigment spot)
  B Honey bee (compound eye)
  C Octopus (eye)
  D Human (eye)

1 Pigment spot (light sensitive)
2 Lens
3 Light sensitive cells
4 Sensory nerve fibers
5 Section through compound eye
6 Section through octopus eye
7 Retina (light sensitive cells)
8 Section through human eye

©DIAGRAM

## Messenger RNA codons

| FIRST LETTER | SECOND LETTER | | | | THIRD LETTER |
|---|---|---|---|---|---|
| | U | C | A | G | |
| U | Phenylalanine | Serine | Tyrosine | Cysteine | U |
| U | Phenylalanine | Serine | Tyrosine | Cysteine | C |
| U | Leucine | Serine | Stop | Stop | A |
| U | Leucine | Serine | Stop | Tryptophan | G |
| C | Leucine | Proline | Histidine | Arginine | U |
| C | Leucine | Proline | Histidine | Arginine | C |
| C | Leucine | Proline | Glutamine | Arginine | A |
| C | Leucine | Proline | Glutamine | Arginine | G |
| A | Isoleucine | Threonine | Asparagine | Serine | U |
| A | Isoleucine | Threonine | Asparagine | Serine | C |
| A | Isolecuine | Threonine | Lysine | Arginine | A |
| A | Start-Methionine | Threonine | Lysine | Arginine | G |
| G | Valine | Alanine | Aspartic acid | Glycine | U |
| G | Valine | Alanine | Aspartic acid | Glycine | C |
| G | Valine | Alanine | Glutamic acid | Glycine | A |
| G | Valine | Alanine | Glutamic acid | Glycine | G |

©DIAGRAM

mRNA bases
U = Uracil
C = Cytosine
A = Adenine
G = Guanine

## Amino acids
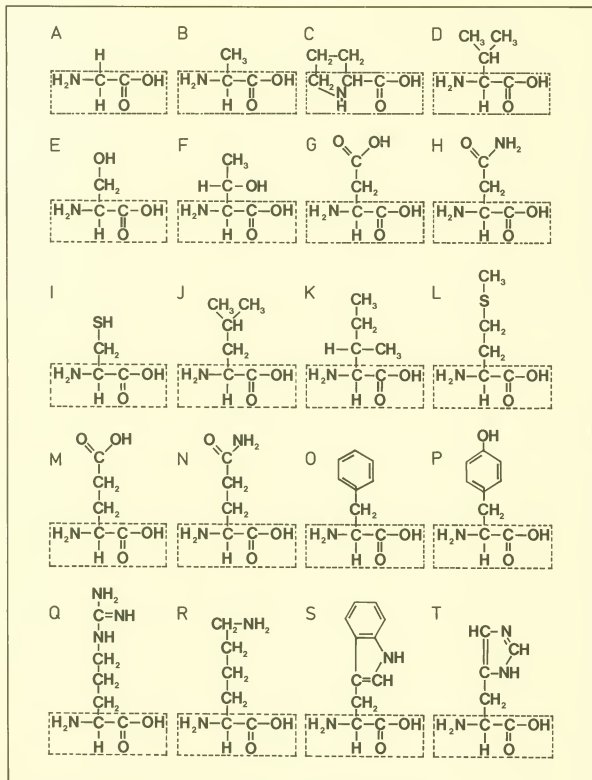
A Glycine (gly)
B Alanine (ala)
C Proline (pro)
D Valine (val)
E Serine (ser)
F Threonine (thr)
G Aspartic acid (asp)

H Asparagine (asn)
I Cysteine (cys)
J Leucine (leu)
K Isoleucine (ile)
L Methionine (met)
M Glutamic acid (glu)
N Glutamine (gln)

O Phenylalanine (phe)
P Tyrosine (tyr)
Q Arginine (arg)
R Lysine (lys)
S Tryptophan (trp)
T Histidine (his)

©DIAGRAM
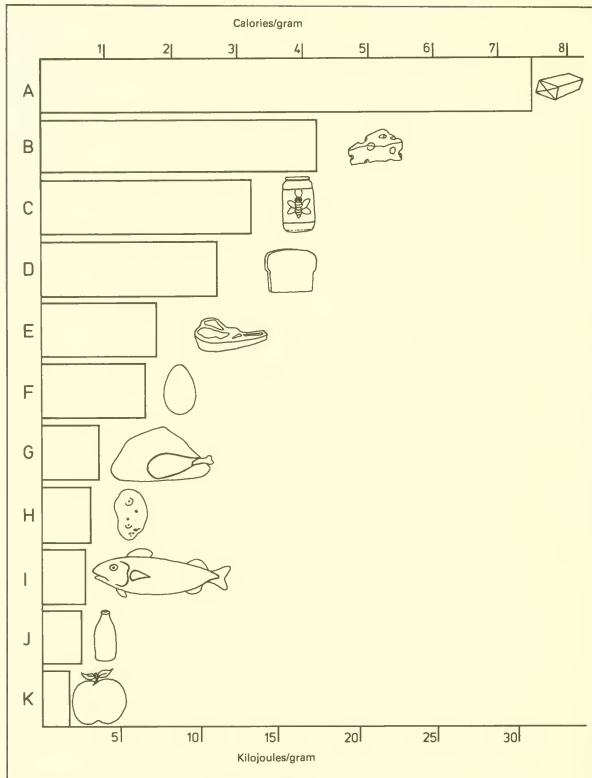
## Food energy value

Energy values per gram
A Butter (7.44 Cals; 31.26 kJ)
B Cheese (4.23 Cals; 17.78 kJ)
C Honey (3.25 Cals; 13.0 kJ)
D Bread (2.77 Cals; 11.1 kJ)
E Meat (1.77 Cals; 7.43 kJ)
F Egg (1.62 Cals; 6.81 kJ)
G Chicken (0.89 Cals; 3.72 kJ)
H Potato (0.79 Cals; 3.33 kJ)
I Cod (0.72 Cals; 2.9 kJ)
J Milk (0.67 Cals; 2.82 kJ)
K Apple (0.47 Cals; 1.96 kJ)

# Energy needs

Kilocalories (Cal) used per 24 hours

Kilojoules (kJ) used per 24 hours
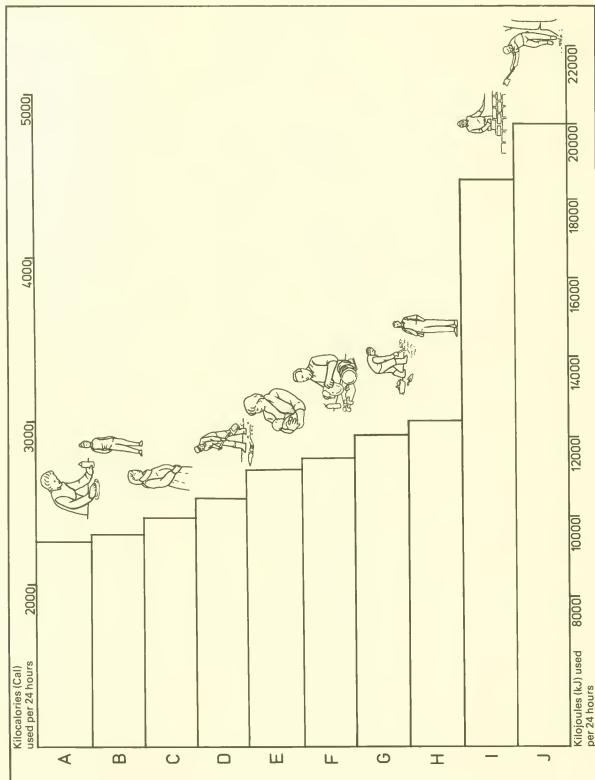
© DIAGRAM

A Woman (light work)
9450 kJ; 2250 Cal
B Girl (15 years old)
9600 kJ; 2285 Cal
C Woman (pregnant)
10000 kJ; 2380 Cal
D Woman (moderate work)
10500 kJ; 2500 Cal
E Woman (breast feeding)
11300 kJ; 2690 Cal
F Man (light work)
11500 kJ; 2750 Cal
G Man (moderate work)
12100 kJ; 2900 Cal
H Boy (15 years old)
12600 kJ; 3000 Cal
I Man (fairly heavy work)
18500 kJ; 4400 Cal
J Man (very heavy work)
20000 kJ; 4800 Cal

## Energy conversions
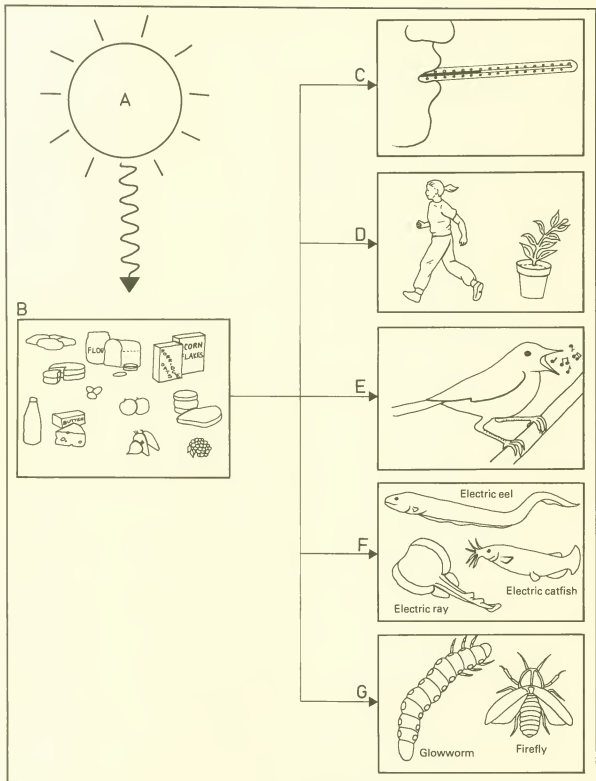
A Light energy
B Chemical energy
  (Light energy is converted by plants into chemical energy. This stored energy is consumed when plants and their derivatives are eaten. Respiration 'unlocks' this 'trapped' energy for use in C-G. Note that heat energy is always a by-product of energy conversions.)
C Heat energy
D Kinetic (movement) energy
E Sound energy
F Electrical energy
G Light energy

## Biogeographical regions
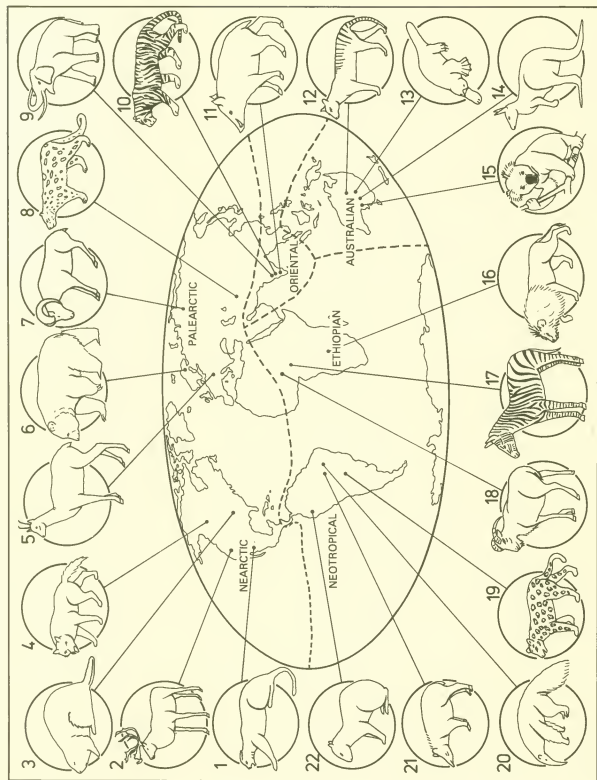
Characteristic animals
1 Cougar
2 Caribou
3 Beaver
4 Wolf
5 Chamois
6 Brown bear
7 Argali
8 Snow leopard
9 Elephant
10 Tiger
11 Indian boar
12 Thylacine
13 Platypus
14 Kangaroo
15 Koala
16 Lion
17 Zebra
18 Aoudad
19 Jaguar
20 Anteater
21 Tapir
22 Agouti

©DIAGRAM

**Terrestrial biomes**

A Arctic tundra and mountain
B Coniferous forest

C Deciduous forest and scrub
D Grassland

E Tropical rain forest
F Desert
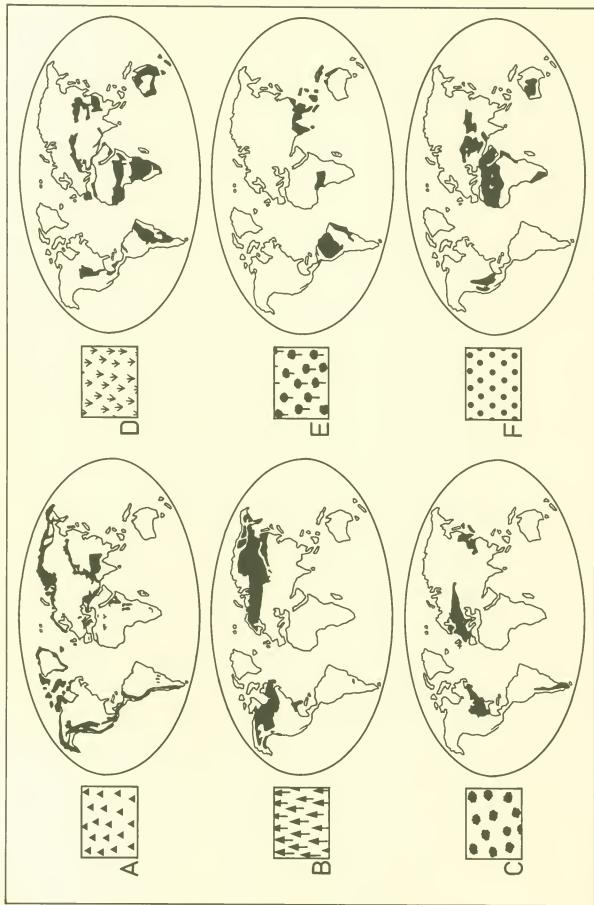
## Effect of temperature and rainfall on vegetation
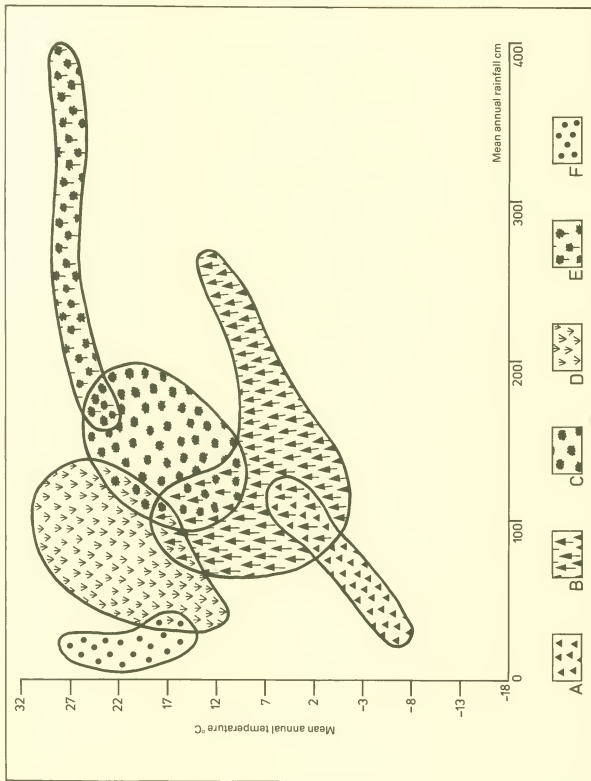
Mean annual rainfall cm

Mean annual temperature °C

A Arctic tundra and
  mountain
B Coniferous forest
C Deciduous forest and
  scrub
D Grassland
E Tropical rain forest
F Desert

©DIAGRAM

## Altitude, latitude and ecosystems

Horizontal climatic regions
A Tropical
B Temperate
C Taiga
D Tundra
E Polar

Mountain climatic regions
a Tropic-like
b Temperate-like
c Taiga-like
d Tundra-like
e Polar-like

Vegetation
1 Snow, ice
2 Mosses, lichens
3 Coniferous forest
4 Deciduous forest
5 Tropical forest
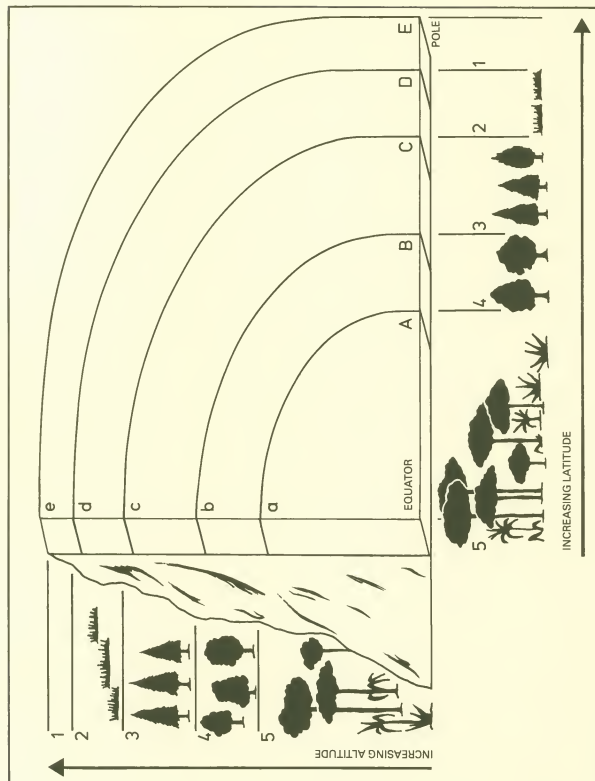
©DIAGRAM

# Woodland food web
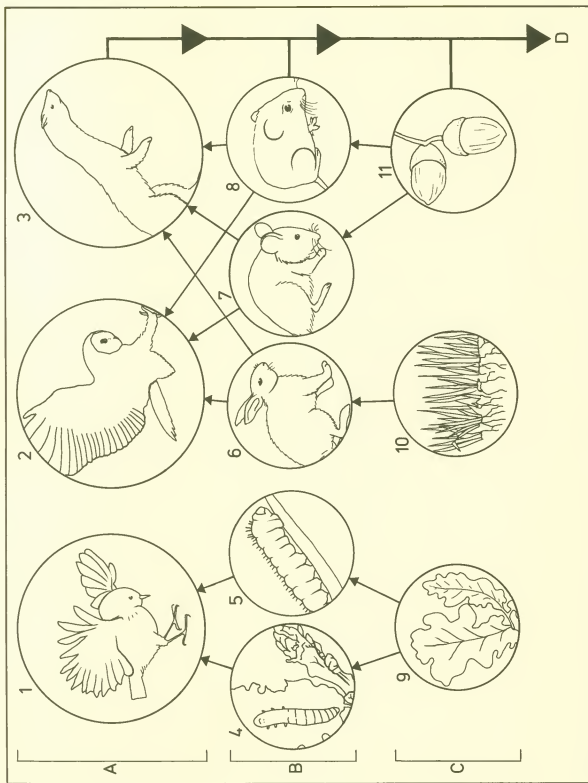
A Secondary
  consumers
B Primary consumers
C Producers
D Decomposers

1 Chickadee
2 Screech owl
3 Weasel
4 Green tortrix
5 Caterpillar
6 Rabbit
7 Deer mouse
8 Red-backed vole
9 Oak leaf
10 Grass
11 Seeds

©DIAGRAM
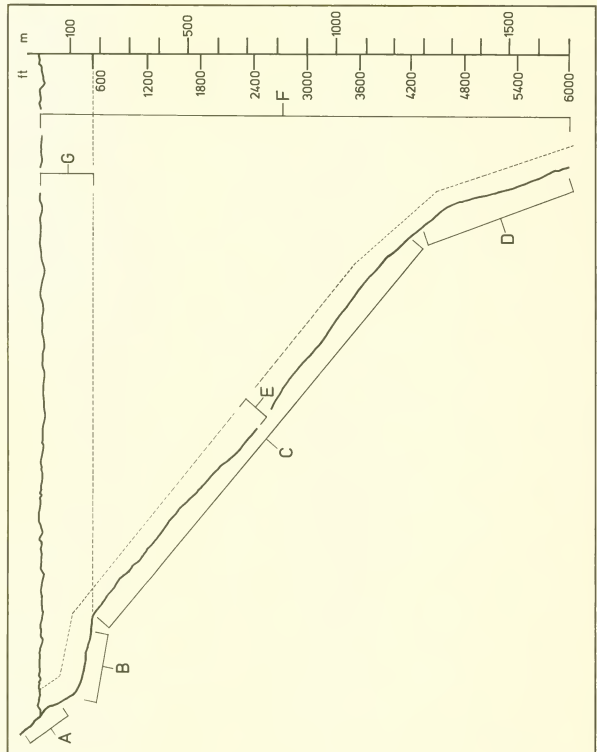
## Marine biomes: 1

A Intertidal zone
B Continental shelf
C Continental slope
D Abyss
E Benthic zone (bottom)
F Pelagic zone (ocean water)
G Limit of light penetration

©DIAGRAM

## Marine biomes: 2
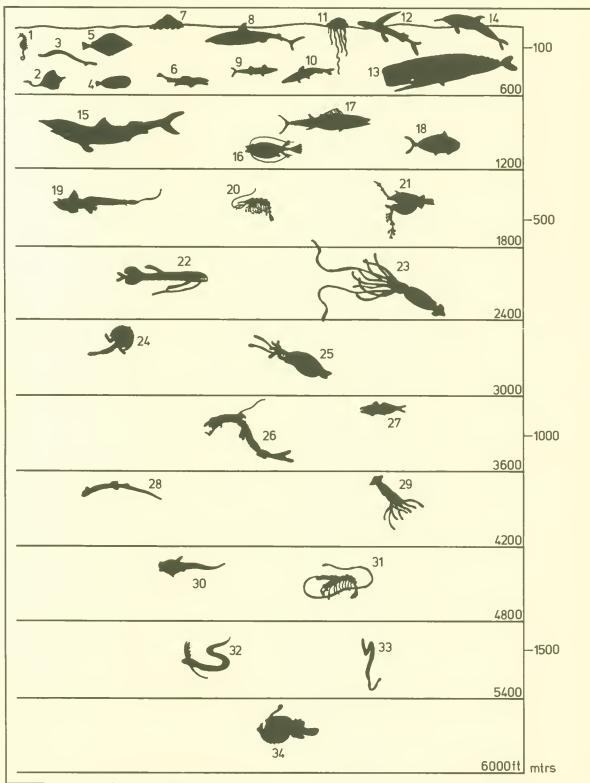
Name of organism and
approximate size
1 Sea horse (7 in)
2 Common skate (6 ft wide)
3 Common eel (2 ft 6 in)
4 Sole (12 in)
5 Halibut (3 ft)
6 Cod (2 ft 6 in)
7 By-the-wind-sailor (2 in)

8 Basking shark (25 ft)
9 Mackerel (12 in)
10 Herring (9 in)
11 Portuguese man-of-war (10 in)
12 Flying fish (9 in)
13 Sperm whale (50 ft)
14 Common dolphin (7 ft)
15 Blue shark (15 ft)
16 Angler (1½ in)

17 Short-finned tunny (8 ft)
18 Hatchet fish (4 in)
19 Rabbit fish (3 ft)
20 Prawn (3 in)
21 Devilfish (3 in)
22 A stomiatoid fish (12 in)
23 Giant squid (40 ft)
24 Bat fish (5 in)
25 Squid (5 in)

26 Viper fish (12 in)
27 Cross-toothed perch (5 in)
28 Giant-tail (12 in)
29 Wonderlamp squid (5 in)
30 Big-headed rat-tail (12 in)
31 Prawn (22 in)
32 Oar fish (12 ft)
33 Angler eel (18 in)
34 Angler fish (4 in)

©DIAGRAM

## Marine food web
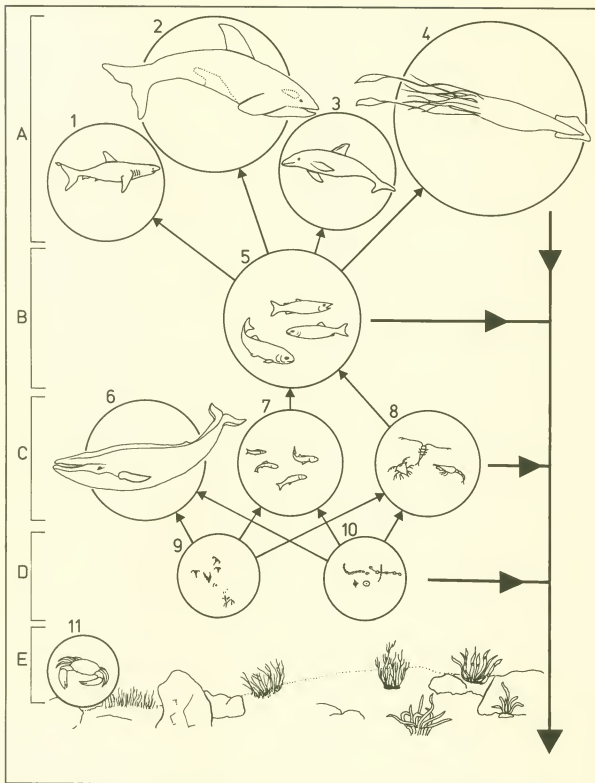
A  Tertiary consumers
B  Secondary consumers
C  Primary consumers
D  Producers
E  Decomposers

1  Sharks
2  Killer whales
3  Dolphins
4  Giant squids
5  Large fish
6  Baleen whales
7  Smaller fish
8  Small crustaceans
9  Dinoflagellates
10 Diatoms
11 Scavengers

## Freshwater food web
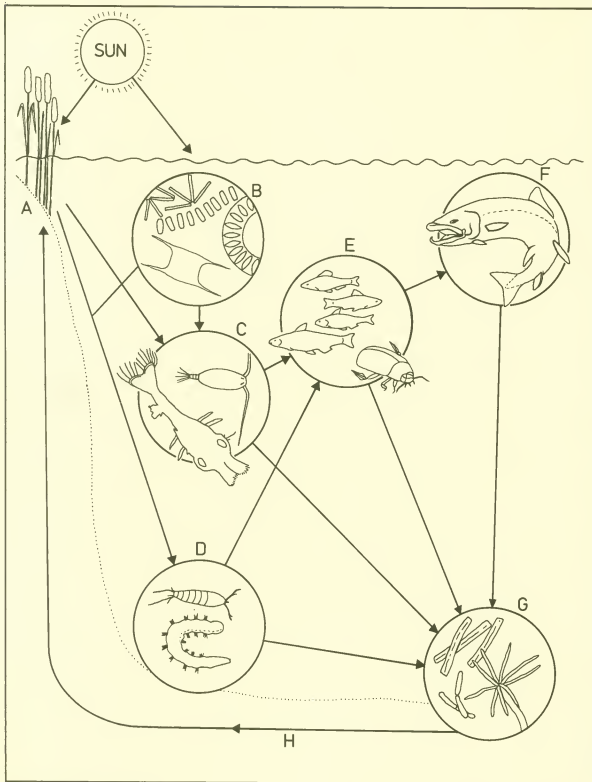
A Producers (rooted vegetation)
B Producers (phytoplankton)
C Primary consumers (zooplankton)
D Primary consumers (bottom dwellers)
E Secondary consumers
F Tertiary consumers
G Decomposers (bacteria and fungi)
H Nutrients for recycling through producers

©DIAGRAM

## Evolution clock
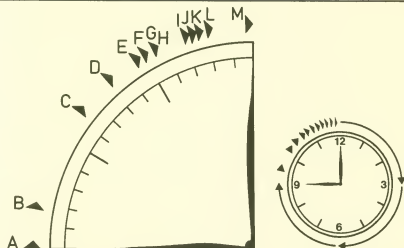
| | EVENT/ORGANISM | TIME OF APPEARANCE | MILLIONS OF YEARS AGO | |
|---|---|---|---|---|
| | Earth formed | 00:00 | 4600 | |
| | Life appeared | 02:52 | 3500 | |
| A | Protist | 09:00 | 1150 | |
| B | Plant | 09:24 | 1000 | |
| C | Crustacean | 10:18 | 650 | |
| D | Fish | 10:40 | 510 | |
| E | Land plant | 10:50 | 400 | |
| F | Insect | 11:02 | 370 | |
| G | Seed plant | 11:05 | 350 | |
| H | Amphibian | 11:05 | 350 | |
| I | Dinosaur | 11:28 | 205 | |
| J | Mammal | 11:30 | 190 | |
| K | Bird | 11:36 | 150 | |
| L | Flowering plant | 11:38 | 140 | |
| M | Human | 11:59:23 | 4 | |

## Tree of life
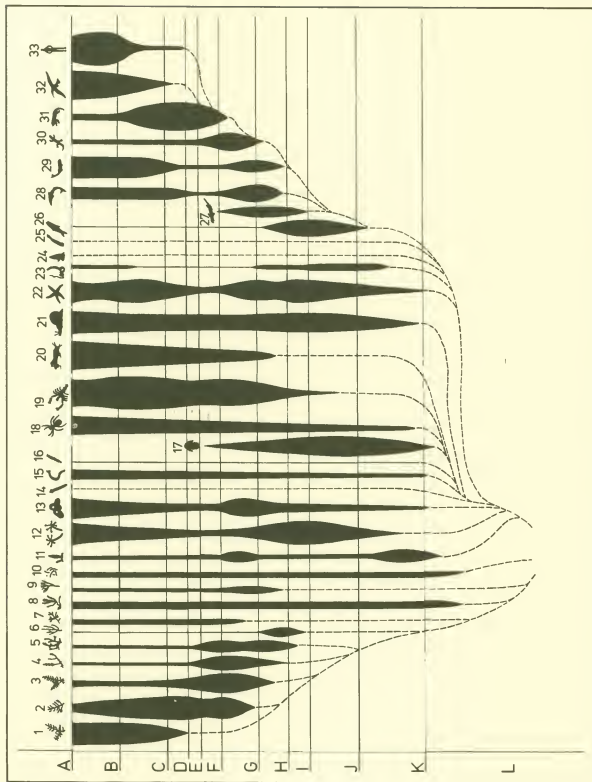
Geologic time period
A Quaternary
B Tertiary
C Cretaceous
D Jurassic
E Triassic
F Permian
G Carboniferous
H Devonian
I Silurian
J Ordovician
K Cambrian
L Proterozoic

Organisms
1 Angiosperms
2 Gymnosperms
3 Ferns
4 Horsetails
5 Clubmosses
6 Psilopsides
7 Bryophytes
8 Algae
9 Fungi
10 Bacteria
11 Sponges
12 Coelenterates
13 Protists
14 Flatworms
15 Annelids
16 Onychophora
17 Trilobites
18 Arachnids
19 Crustacea
20 Insects
21 Mollusks
22 Echinoderms
23 Hemichordates
24 Urochordates
25 Cephalochordates
26 Agnatha
27 Placoderms
28 Cartilaginous fish
29 Bony fish
30 Amphibians
31 Reptiles
32 Birds
33 Mammals

©DIAGRAM

## Biological dimensions

Microscope capabilities in comparison to the sizes of organisms, cells and molecules.
A Elephant
B Human
C Mouse
D Fruit fly
E Human ovum
F Red blood cell
G Bacterium
H Chromosome
I Virus
J Protein
K Atom

UNAIDED EYE

COMPOUND MICROSCOPE

ELECTRON MICROSCOPE

10m  1m  100mm  10mm  1mm  100µm  10µm  1µm  100nm  10nm  1nm  0.1nm  0.01nm

Logarithmic scale
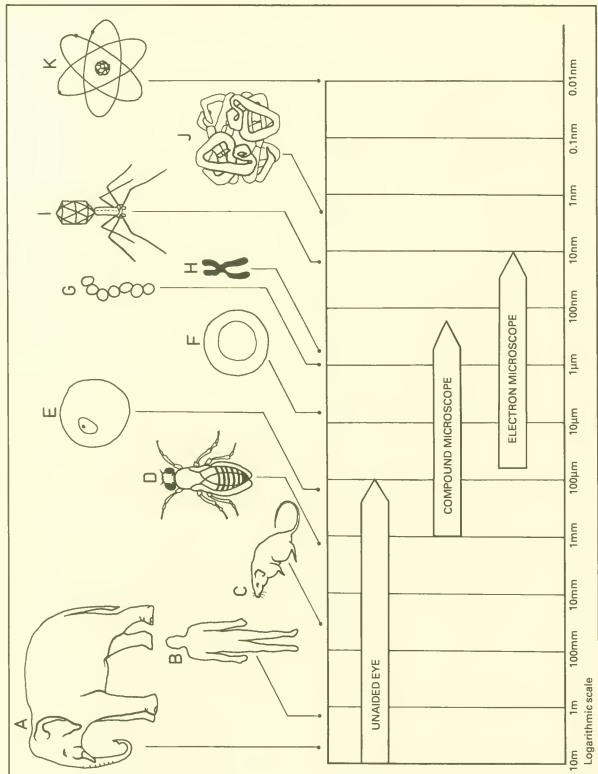
©DIAGRAM

## Animal sizes
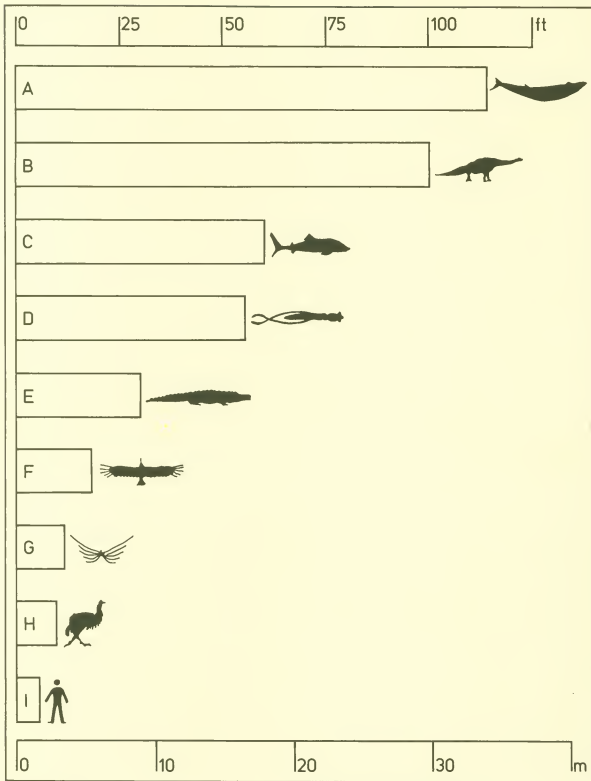
Largest animals
* = Extinct species
 A  Mammal: blue whale (110.5ft 33.6m)
*B  Reptile: *Ultrasaurus* (100.3ft 30.5m)
 C  Fish: whale shark (60ft 18m)
 D  Mollusk: giant squid (56ft 17m)
*E  Amphibian: *Prionosuchus* (30ft 9m)
*F  Bird: *Teratornis* (18ft 5.5m wingspan)
 G  Arthropod: Japanese spider crab (12.5ft 3.8m width)
*H  Bird: *Aepyornis* (9.8ft 3m height)
 I  Mammal: human (6ft 1.8m height)

©DIAGRAM

**Plant sizes**
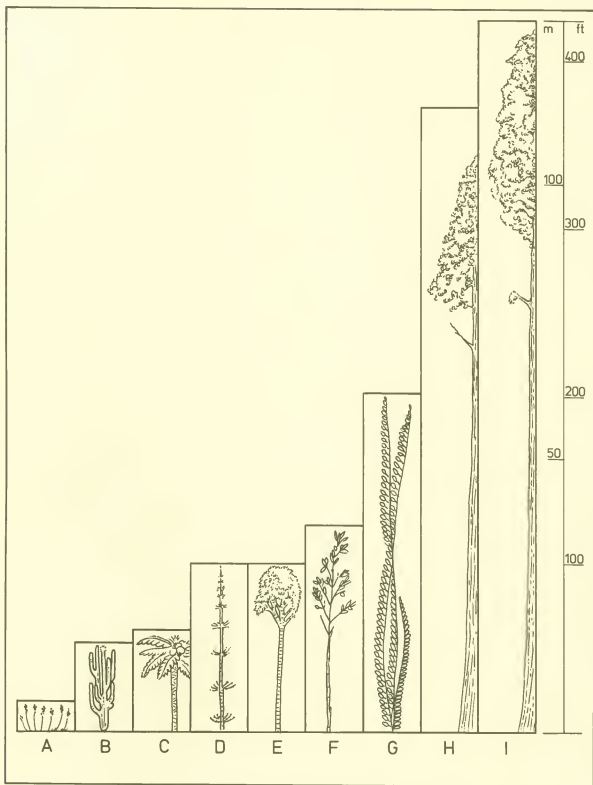
Tallest plants
* = Extinct species
  **A** Callie grass (18ft 5.5m)
  **B** Saguara cactus (52.6ft 16m)
  **C** Tree fern (59.2ft 18m)
*__D__ Giant horsetail (100ft 30m)
*__E__ Giant club moss (100ft 30m)
  **F** Bamboo (122ft 37m)
  **G** Giant kelp seaweed (200ft 60m)
  **H** Coast redwood conifer (368.5ft 112m)
  **I** *Eucalyptus regnans* (483.3ft 132m)

©DIAGRAM

## Gestation and incubation

A  **Incubation time in reptiles (days)**
1  Australian skink 30
2  Grass lizard 42
3  Marine turtle 55
4  Hog-nosed snake 60
5  Alligator 61
6  Python 61.5
7  Spiny lizard 63
8  Box turtle 87
9  Viviparous lizard 90
10  Tortoise 105

B  **Incubation time in birds (days)**
11  Finch 12
12  Thrush 14
13  Wren 16
14  Pheasant 21.5
15  Falcon 28.5
16  Swan 30
17  Ostrich 42
18  Hawk 44
19  Emperor penguin 63
20  Royal albatross 79

C  **Gestation time in mammals (days)**
21  Common opossum 13
22  House mouse 19
23  Dog 63
24  Goat 151
25  Chimpanzee 237
26  Woman 265
27  Camel 406
28  Giraffe 410
29  Rhinoceros 560
30  Indian elephant 624

©DIAGRAM

## Life spans

Average life spans (years)
A Tortoise 100
B Human ♂ 68 ♀ 76
C Rhinoceros 70
D Raven 69
E Dolphin 65
F Macaw 63
G African elephant 60
H Alligator 55
I Ostrich 50
J Pelican 45
K Hippopotamus 40
L Horse 30
M Lion 25
N Owl 24
O Rattlesnake 18
P Cat 13-17
Q Sheep 10-15
R Rabbit 12
S Squirrel 11
T Trout 5-10
U Mouse 2
V Adult mayfly 1 day

©DIAGRAM

## Life levels
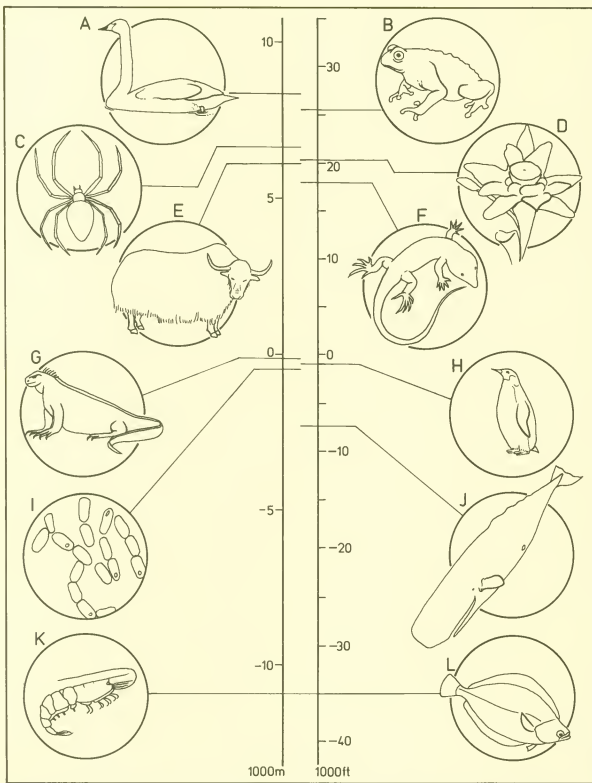
A-F Highest level at which six kinds of living things have
been observed
A Bird: whooper swan 27,077ft/8,230m
B Amphibian: toad 26,000ft/8,000m
C Arthropod: spider 22,000ft/6,700m
D Flowering plant 20,130ft/6,400m
E Mammal: yak 20,000ft/6,100m
F Reptile: lizard 18,100ft/5,500m

G-L The lowest levels at which these living things have
been observed
G Reptile: marine iguana −33ft/−10m
H Bird: emperor penguin −872ft/−265m
I Blue-green alga −1,300ft/−400m
J Mammal: sperm whale −7,400ft/−2,250m
K Arthropod: shrimp −35,800ft/−10,900m
L Fish: flat fish −35,800ft/−10,900m

## Animal speeds: fastest
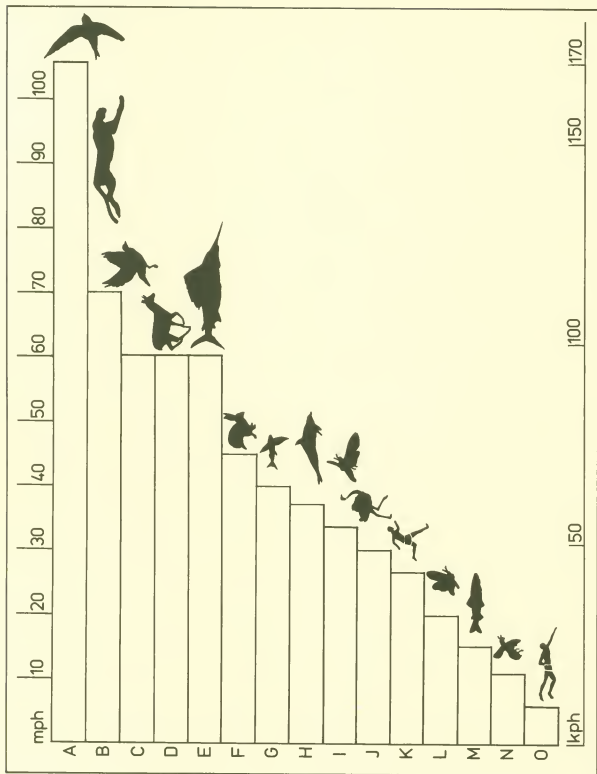
Animals and speeds
A Spine-tailed swift
106.25 mph 171 kph
B Cheetah 70 mph
112.6 kph
C Pigeon 60 mph
96.5 kph
D Prong-horned antelope
60 mph 96.5 kph
E Sailfish 60 mph
96.5 kph
F Jackrabbit 45 mph
72.4 kph
G Flying fish 40 mph
64.4 kph
H Dolphin 37 mph 60 kph
I Hawk moth 33 mph
48 kph
J Ostrich 30 mph 48 kph
K Human (running)
27 mph 43.4 kph
L Monarch butterfly
20mph 32 kph
M Trout 15 mph 24 kph
N Honey bee 11 mph
17.7 kph
O Human (swimming)
5.19 mph 8.3 kph

©DIAGRAM

## Animal speeds: slowest
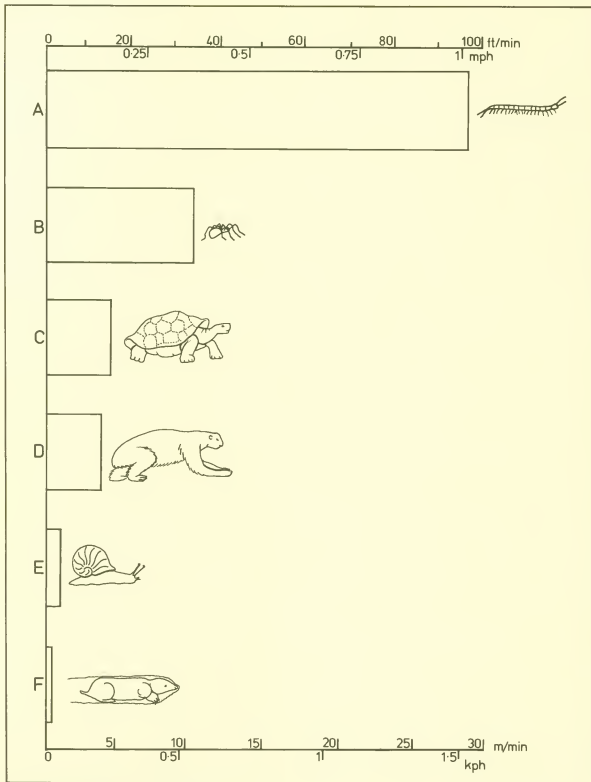
Animals and speeds
A Centipede 96 ft/min
  29.3 m/min
B Spider 37 ft/min
  11.2 m/min
C Giant tortoise 15 ft/min
  4.6 m/min
D Three-toed sloth
  13.2 ft/min 4 m/min
E Garden snail 2.7 ft/min
  0.82 m/min
F Burrowing mole
  0.69 ft/min 0.21 m/min
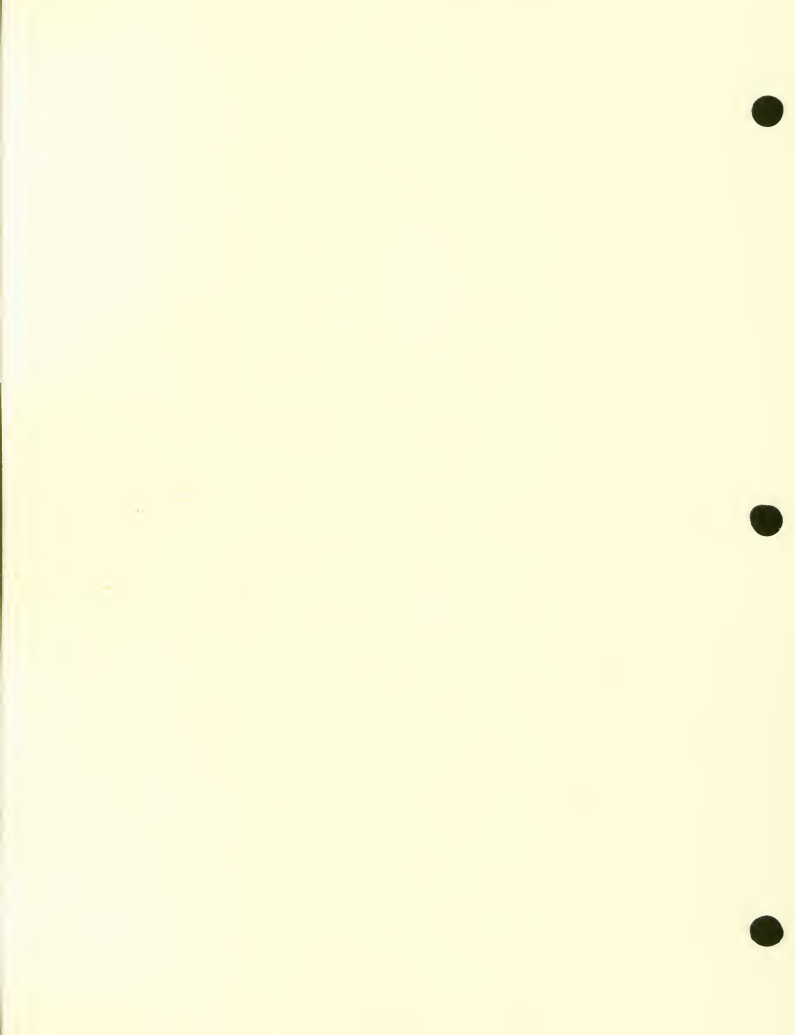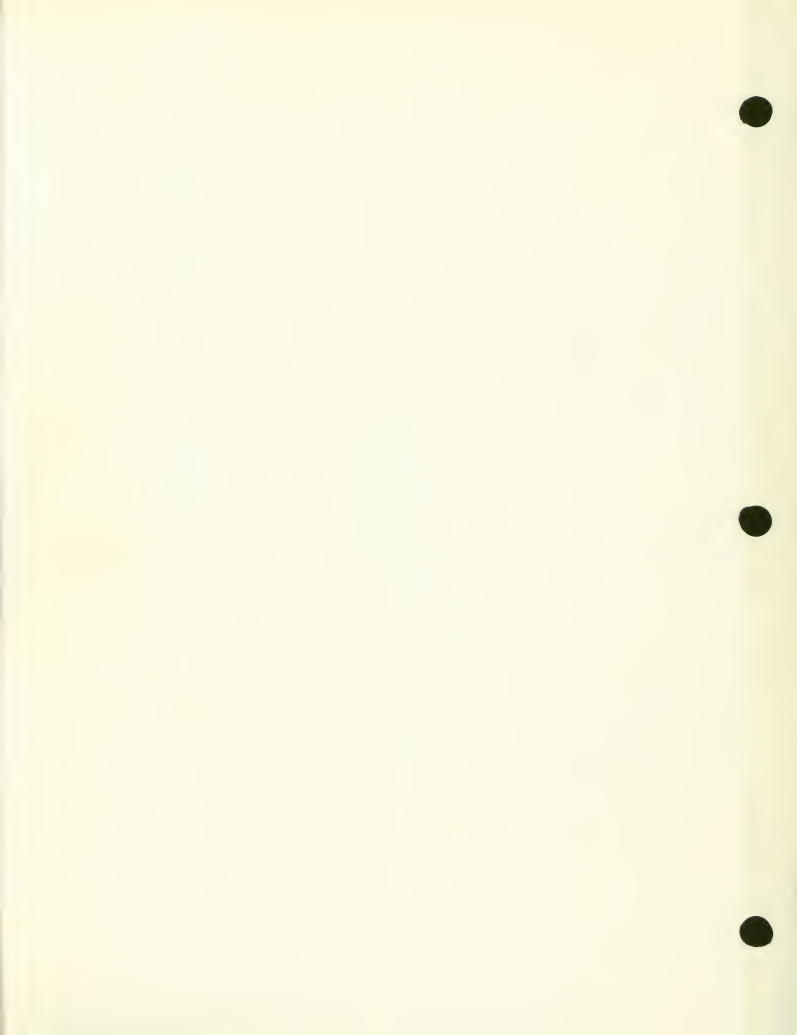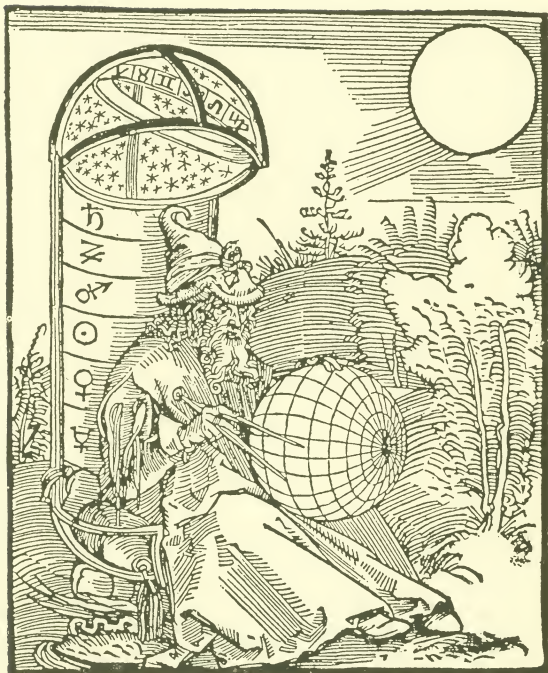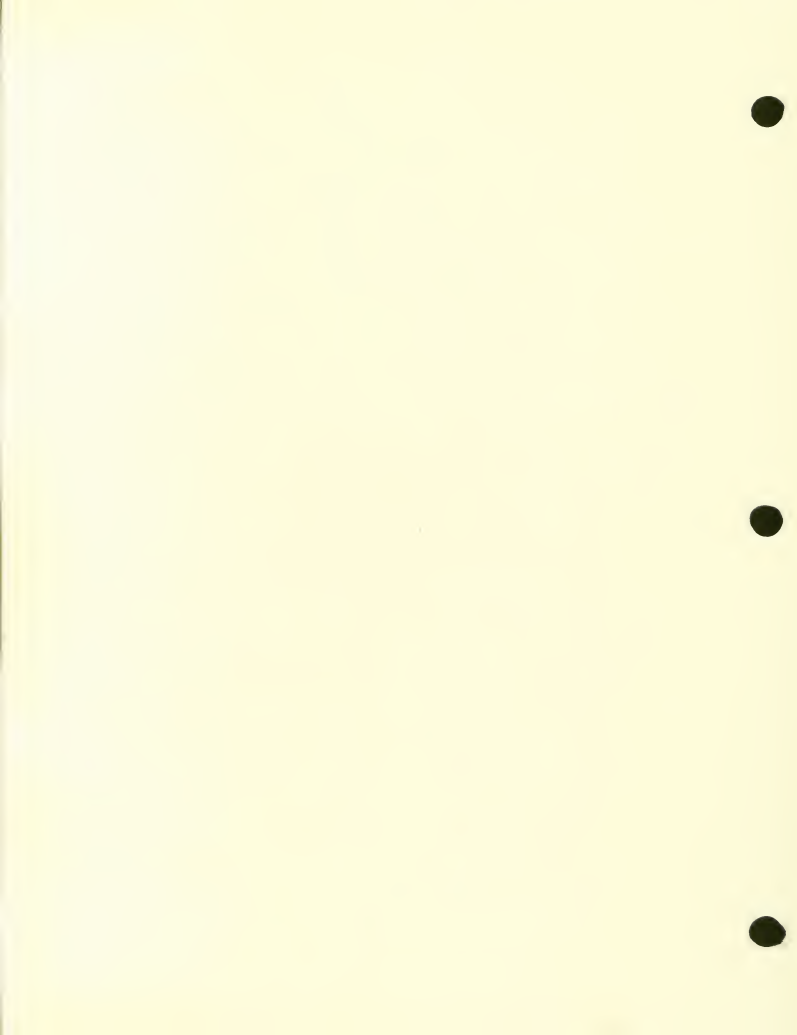
## Roman numerals

| | | | | | |
|---|---|---|---|---|---|
| 1 I | 2 II | 3 III | 4 IV | 5 V | 6 VI |
| 7 VII | 8 VIII | 9 IX | 10 X | 11 XI | 12 XII |
| 13 XIII | 14 XIV | 15 XV | 16 XVI | 17 XVII | 18 XVIII |
| 19 XIX | 20 XX | 30 XXX | 40 XL | 50 L | 60 LX |
| 70 LXX | 80 LXXX | 90 XC | 100 C | 500 D | 1000 M |
| 5000 $\bar{V}$ | 10,000 $\bar{X}$ | 1988 | | | |

MCMLXXXVIII

A single letter before one of greater value subtracts from that letter: 900 = CM. A dash over a letter multiplies the value by 1,000.

©DIAGRAM

## Number systems

| A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | ⊖ | | | | o | • | |
| 1 | Y | I | • | א | A | I | ٢ | ١ | 一 |
| 2 | YY | II | •• | ב | B | II | ٢ | ٢ | 二 |
| 3 | YYY | III | ••• | ג | Γ | III | ٢ | ٣ | 三 |
| 4 | YYYY | IIII | •••• | ד | Δ | IV | ٧ | ٤ | 四 |
| 5 | YYYYY | IIIII | — | ה | E | V | ٧ | ٥ | 五 |
| 6 | YYYYYY | IIIIII | ⋅⋅ | ו | F | VI | ٤ | ٦ | 六 |
| 7 | YYYYYYY | IIIIIII | •• • | ז | Z | VII | ٧ | V | 七 |
| 8 | YYYYYYYY | IIIIIIII | ••• | ח | H | VIII | ٧ | Λ | 八 |
| 9 | YYYYYYYYY | IIIIIIIII | •••• | ט | θ | IX | ٤ | ٩ | 九 |
| 10 | ⟨ | ∩ | ═ | י | I | X | ٢٠ | ١٠ | 十 |
| 50 | ⟨⟨⟨⟨⟨ | ∩∩∩∩∩ | ═ ⋅⋅ | נ | N | L | ٥٠ | ٥٠ | 五十 |
| 100 | Y⟨⟨⟨⟨ | 𝟗 | ⊖ | ק | P | C | ٢٠٠ | ١٠٠ | 百 |
| 500 | YYY⟩ | 𝟗𝟗𝟗𝟗𝟗 | ⊖• | ך | Φ | D | ٥٠٠ | ٥٠٠ | 百五 |
| 1000 | Y⟩ | ꝋ | ⊖ ⋅⋅ | א | /A | M | ٢٠٠٠ | ١٠٠٠ | 千 |

A  Arabic (modern Western)
B  Babylonian
C  Egyptian
D  Mayan
E  Hebrew
F  Ionic
G  Roman
H  Hindu
I  Arabic (c 900 AD)
J  Chinese

©DIAGRAM

## Numerical prefixes

| ALPHABETICAL ORDER | |
|---|---|
| Bi- | 2 |
| Deca- | 10 |
| Deci- | ⅟₁₀ |
| Demi- | ½ |
| Di- | 2 |
| Dodeca- | 12 |
| Ennea- | 9 |
| Hemi- | ½ |
| Hendeca- | 11 |
| Hepta- | 7 |
| Hex-, hexa- | 6 |
| Icos-, icosa-, icosi- | 20 |
| Non-, nona- | 9 |
| Oct-, octa- | 8 |
| Pent-, penta- | 5 |
| Quadr-, quadri- | 4 |
| Quindeca- | 15 |
| Quinqu-, quinque- | 5 |
| Quint- | 5 |
| Semi- | ½ |
| Sept-, septem-, septi | 7 |
| Sex-, sexi | 6 |
| Ter- | 3 |
| Tessara- | 4 |
| Tetr-, tetra- | 4 |
| Tri- | 3 |
| Undec-, undeca- | 11 |
| Uni- | 1 |

| NUMERICAL ORDER |
|---|
| ⅟₁₀ Deci- |
| ½ Semi-, hemi-, demi- |
| 1 Uni- |
| 2 Bi-, di- |
| 3 Tri-, ter- |
| 4 Tetra-, tetr-, tessara-, quadri-, quadr- |
| 5 Pent-, penta-, quinqu-, quinque-, quint- |
| 6 Sex-, sexi-, hex-, hexa- |
| 7 Hepta-, sept-, septi-, septem- |
| 8 Oct- octa- |
| 9 Non-, nona-, ennea- |
| 10 Deca- |
| 11 Hendeca-, undec-, undeca- |
| 12 Dodeca- |
| 15 Quindeca- |
| 20 Icos-, icosa-, icosi- |

## Mathematical symbols

1 Plus
2 Minus
3 Multiplied by
4 Divided by
5 Square root
6 Cube root
7 Smaller than
8 Not smaller than
9 Larger than
10 Not larger than
11 Equal to
12 Approximately equal to
13 Not equal to
14 Identically equal to
15 Angle
16 Parallel to
17 Perpendicular to
18 Is to
19 Therefore
20 Infinity

## Astronomy symbols

1  | 2  | 3  | 4  | 5
6  | 7  | 8  | 9  | 10
11 | 12 | 13 | 14 | 15
16 | 17 | 18 | 19 | 20
21 | 22 | 23 | 24 | 25

| | | |
|---|---|---|
| **1** Sun | **11** Saturn | **21** Opposition |
| **2** New Moon | **12** Neptune | **22** Ascending node |
| **3** First quarter Moon | **13** Uranus | **23** Descending node |
| **4** Full Moon | **14** Pluto | **24** Aries: vernal equinox |
| **5** Last quarter Moon | **15** Star | **25** Libra: autumnal equinox |
| **6** Mercury | **16** Comet | |
| **7** Venus | **17** Galactic cluster | |
| **8** Earth: globular cluster | **18** Planetary nebula | |
| **9** Mars | **19** Galaxy | |
| **10** Jupiter | **20** Conjunction | |
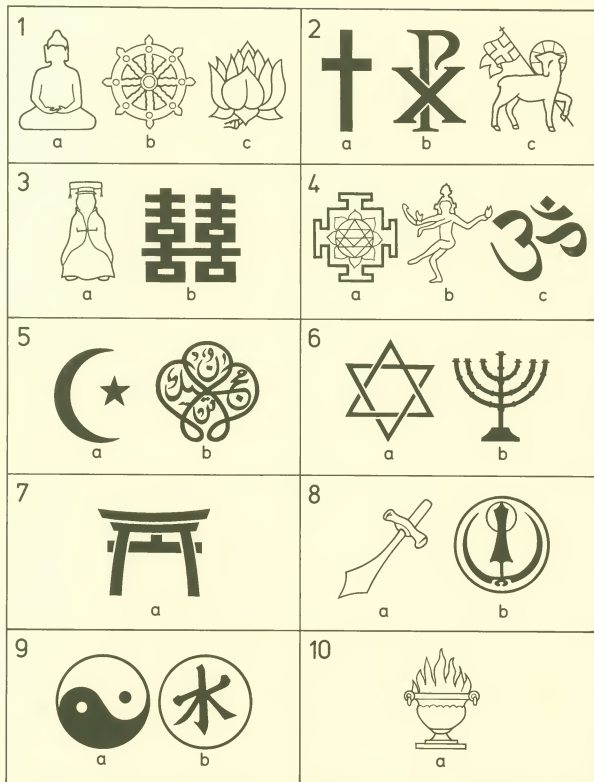
©DIAGRAM

## Religious symbols

| 1 Buddhism | 3 Confucianism | 5 Islam | 8 Sikhism |
|---|---|---|---|
| 1a Buddha | 3a Confucius | 5a Star and crescent | 8a Kirpan |
| 1b Wheel of law | 3b Conjugal bliss | 5b Holy Koran | 8b Khanda |
| 1c Lotus | 4 Hinduism | 6 Judaism | 9 Taoism |
| 2 Christianity | 4a Mandala | 6a Star of David | 9a Yin-Yang |
| 2a Latin cross | 4b Shiva | 6b Menorah | 9b Water |
| 2b Chi Rho | 4c Aum | 7 Shinto | 10 Zoroastrianism |
| 2c Agnus Dei | | 7a Torii | 10a Sacred fire |

©DIAGRAM

## Signs of the Zodiac
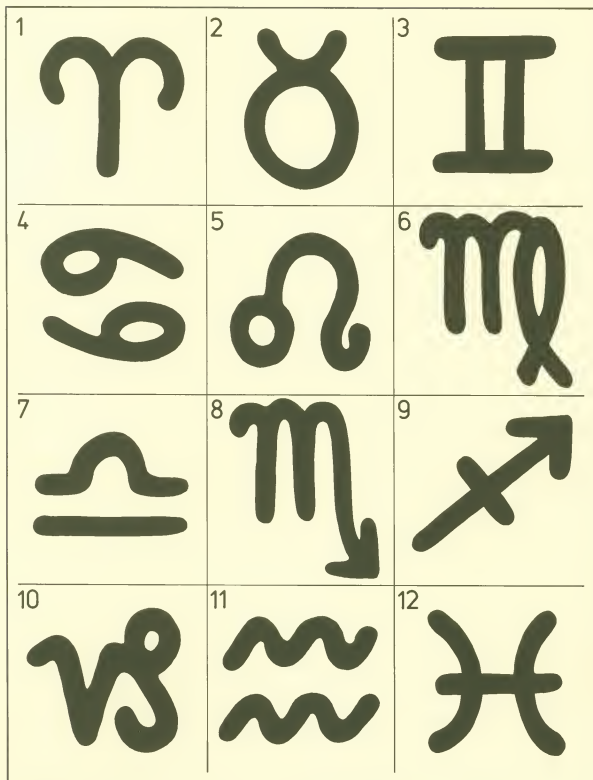
| 1 Aries (Ram) | March 21 – April 20 | 7 Libra (Balance) | September 22 – October 22 |
|---|---|---|---|
| 2 Taurus (Bull) | April 21 – May 20 | 8 Scorpio (Scorpion) | October 23 – November 21 |
| 3 Gemini (Twins) | May 21 – June 20 | 9 Sagittarius (Archer) | November 22 – December 20 |
| 4 Cancer (Crab) | June 21 – July 21 | 10 Capricorn (Goat) | December 21 – January 19 |
| 5 Leo (Lion) | July 22 – August 21 | 11 Aquarius (Water-bearer) | January 20 – February 18 |
| 6 Virgo (Virgin) | August 22 – September 21 | 12 Pisces (Fish) | February 19 – March 20 |

## Chinese astrological symbols and year dates

| | | | | | | |
|---|---|---|---|---|---|---|
| **BUFFALO** | **1925** Jan 25, 1925- Feb 13, 1926 | **1937** Feb 12, 1937- Jan 31, 1938 | **1949** Jan 30, 1949- Feb 17, 1950 | **1961** Feb 16, 1961- Feb 4, 1962 | **1973** Feb 3, 1973- Jan 23, 1974 | **1985** Feb 20, 1985- Feb 8, 1986 |
| **TIGER** | **1926** Feb 14, 1926- Feb 2, 1927 | **1938** Feb 1, 1938- Feb 18, 1939 | **1950** Feb 18, 1950- Feb 6, 1951 | **1962** Feb 5, 1962- Jan 25, 1963 | **1974** Jan 24, 1974- Feb 10, 1975 | **1986** Feb 9, 1986- Jan 28, 1987 |
| **RABBIT** | **1927** Feb 3, 1927- Jan 22, 1928 | **1939** Feb 19, 1939- Feb 7, 1940 | **1951** Feb 7, 1951- Jan 26, 1952 | **1963** Jan 26, 1963- Feb 13, 1964 | **1975** Feb 11, 1975- Jan 30, 1976 | **1987** Jan 29, 1987- Feb 16, 1988 |
| **DRAGON** | **1928** Jan 23, 1928- Feb 10, 1929 | **1940** Feb 8, 1940- Jan 27, 1941 | **1952** Jan 27, 1952- Feb 14, 1953 | **1964** Feb 14, 1964- Feb 2, 1965 | **1976** Jan 31, 1976- Feb 17, 1977 | **1988** Feb 17, 1988- Feb 5, 1989 |
| **SNAKE** | **1929** Feb 11, 1929- Jan 30, 1930 | **1941** Jan 28, 1941- Feb 15, 1942 | **1953** Feb 15, 1953- Feb 3, 1954 | **1965** Feb 3, 1965- Jan 21, 1966 | **1977** Feb 18, 1977- Feb 7, 1978 | **1989** Feb 6, 1989- Jan 26, 1990 |
| **HORSE** | **1930** Jan 31, 1930- Feb 17, 1931 | **1942** Feb 16, 1942- Feb 4, 1943 | **1954** Feb 4, 1954- Jan 23, 1955 | **1966** Jan 22, 1966- Feb 8, 1967 | **1978** Feb 8, 1978- Jan 27, 1979 | **1990** Jan 27, 1990- Feb 14, 1991 |
| **GOAT** | **1931** Feb 18, 1931- Feb 6, 1932 | **1943** Feb 5, 1943- Jan 25, 1944 | **1955** Jan 24, 1955- Feb 11, 1956 | **1967** Feb 9, 1967- Jan 29, 1968 | **1979** Jan 28, 1979- Feb 15, 1980 | **1991** Feb 15, 1991- Feb 3, 1992 |
| **MONKEY** | **1932** Feb 7, 1932- Jan 25, 1933 | **1944** Jan 26, 1944- Feb 12, 1945 | **1956** Feb 12, 1956- Jan 30, 1957 | **1968** Jan 30, 1968- Feb 16, 1969 | **1980** Feb 16, 1980- Feb 4, 1981 | **1992** Feb 4, 1992- Jan 22, 1993 |
| **ROOSTER** | **1933** Jan 26, 1933- Feb 13, 1934 | **1945** Feb 13, 1945- Feb 1, 1946 | **1957** Jan 31, 1957- Feb 18, 1958 | **1969** Feb 17, 1969- Feb 5, 1970 | **1981** Feb 5, 1981- Jan 24, 1982 | **1993** Jan 23, 1993- Feb 9, 1994 |
| **DOG** | **1934** Feb 14, 1934- Feb 4, 1935 | **1946** Feb 2, 1946- Jan 21, 1947 | **1958** Feb 19, 1958- Feb 7, 1959 | **1970** Feb 6, 1970- Jan 26, 1971 | **1982** Jan 25, 1982- Feb 12, 1983 | **1994** Feb 10, 1994- Jan 30, 1995 |
| **PIG** | **1935** Feb 5, 1935- Jan 23, 1936 | **1947** Jan 22, 1947- Feb 9, 1948 | **1959** Feb 8, 1959- Jan 27, 1960 | **1971** Jan 27, 1971- Feb 18, 1972 | **1983** Feb 13, 1983- Feb 1, 1984 | **1995** Jan 31, 1995- Feb 18, 1996 |
| **RAT** | **1936** Jan 24, 1936- Feb 11, 1937 | **1948** Feb 10, 1948- Jan 29, 1949 | **1960** Jan 28, 1960- Feb 15, 1961 | **1972** Feb 19, 1972- Feb 2, 1973 | **1984** Feb 2, 1984- Feb 19, 1985 | |

## Calendars : Gregorian, Hebrew, Moslem

| MOSLEM | | |
|---|---|---|
| NAME | NUMBER OF DAYS | |
| Muharram | 30 | |
| Safar | 29 | |
| Rabi I | 30 | |
| Rabi II | 29 | |
| Jumada I | 30 | |
| Jumada II | 29 | |
| Rajab | 30 | |
| Sha'ban | 29 | |
| Ramadan | 30 | |
| Shawwal | 29 | |
| Dhu'l-Qa'dah | 30 | |
| Dhu'l-Hijja | 29 (30 in leap year) | |

| HEBREW | |
|---|---|
| NAME | NUMBER OF DAYS |
| Tishri | 30 |
| Heshvan | 29 (30 in some years) |
| Kislev | 29 (30 in some years) |
| Tevet | 29 |
| Shevat | 30 |
| Adar | 29 (30 in leap year) |
| Nisan | 30 |
| Iyar | 29 |
| Sivan | 30 |
| Tammuz | 29 |
| Av | 30 |
| Elul | 29 |

| GREGORIAN | |
|---|---|
| NAME | NUMBER OF DAYS |
| January | 31 |
| February | 28 (29 in leap year) |
| March | 31 |
| April | 30 |
| May | 31 |
| June | 30 |
| July | 31 |
| August | 31 |
| September | 30 |
| October | 31 |
| November | 30 |
| December | 31 |

©DIAGRAM

## Perpetual calendar: key

| Year | Key | Year | Key | Year | Key | Year | Key | Year | Key | Year | Key |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1780 | N | 1820 | N | 1860 | H | 1900 | B | 1940 | I | 1980 | J |
| 1781 | B | 1821 | B | 1861 | C | 1901 | C | 1941 | D | 1981 | E |
| 1782 | C | 1822 | C | 1862 | D | 1902 | D | 1942 | E | 1982 | F |
| 1783 | D | 1823 | D | 1863 | E | 1903 | E | 1943 | F | 1983 | G |
| 1784 | L | 1824 | L | 1864 | M | 1904 | M | 1944 | N | 1984 | H |
| 1785 | G | 1825 | G | 1865 | A | 1905 | A | 1945 | B | 1985 | C |
| 1786 | A | 1826 | A | 1866 | B | 1906 | B | 1946 | C | 1986 | D |
| 1787 | B | 1827 | B | 1867 | C | 1907 | C | 1947 | D | 1987 | E |
| 1788 | J | 1828 | J | 1868 | K | 1908 | K | 1948 | L | 1988 | M |
| 1789 | E | 1829 | E | 1869 | F | 1909 | F | 1949 | G | 1989 | A |
| 1790 | F | 1830 | F | 1870 | G | 1910 | G | 1950 | A | 1990 | B |
| 1791 | G | 1831 | G | 1871 | A | 1911 | A | 1951 | B | 1991 | C |
| 1792 | H | 1832 | H | 1872 | I | 1912 | I | 1952 | J | 1992 | K |
| 1793 | C | 1833 | C | 1873 | D | 1913 | D | 1953 | E | 1993 | F |
| 1794 | D | 1834 | D | 1874 | E | 1914 | E | 1954 | F | 1994 | G |
| 1795 | E | 1835 | E | 1875 | F | 1915 | F | 1955 | G | 1995 | A |
| 1796 | M | 1836 | M | 1876 | N | 1916 | N | 1956 | H | 1996 | I |
| 1797 | A | 1837 | A | 1877 | B | 1917 | B | 1957 | C | 1997 | D |
| 1798 | B | 1838 | B | 1878 | C | 1918 | C | 1958 | D | 1998 | E |
| 1799 | C | 1839 | C | 1879 | D | 1919 | D | 1959 | E | 1999 | F |
| 1800 | D | 1840 | K | 1880 | L | 1920 | L | 1960 | M | 2000 | N |
| 1801 | E | 1841 | F | 1881 | G | 1921 | G | 1961 | A | 2001 | B |
| 1802 | F | 1842 | G | 1882 | A | 1922 | A | 1962 | B | 2002 | C |
| 1803 | G | 1843 | A | 1883 | B | 1923 | B | 1963 | C | 2003 | D |
| 1804 | H | 1844 | I | 1884 | J | 1924 | J | 1964 | K | 2004 | L |
| 1805 | C | 1845 | D | 1885 | E | 1925 | E | 1965 | F | 2005 | G |
| 1806 | D | 1846 | E | 1886 | F | 1926 | F | 1966 | G | 2006 | A |
| 1807 | E | 1847 | F | 1887 | G | 1927 | G | 1967 | A | 2007 | B |
| 1808 | M | 1848 | N | 1888 | H | 1928 | H | 1968 | I | 2008 | J |
| 1809 | A | 1849 | B | 1889 | C | 1929 | C | 1969 | D | 2009 | E |
| 1810 | B | 1850 | C | 1890 | D | 1930 | D | 1970 | E | 2010 | F |
| 1811 | C | 1851 | D | 1891 | E | 1931 | E | 1971 | F | 2011 | G |
| 1812 | K | 1852 | L | 1892 | M | 1932 | M | 1972 | N | 2012 | H |
| 1813 | F | 1853 | G | 1893 | A | 1933 | A | 1973 | B | 2013 | C |
| 1814 | G | 1854 | A | 1894 | B | 1934 | B | 1974 | C | 2014 | D |
| 1815 | A | 1855 | B | 1895 | C | 1935 | C | 1975 | D | | |
| 1816 | I | 1856 | J | 1896 | K | 1936 | K | 1976 | L | | |
| 1817 | D | 1857 | E | 1897 | F | 1937 | F | 1977 | G | | |
| 1818 | E | 1858 | F | 1898 | G | 1938 | G | 1978 | A | | |
| 1819 | F | 1859 | G | 1899 | A | 1939 | A | 1979 | B | | |

©DIAGRAM

How to use the calendar.
To discover on which day of the week any date between the years 1780 to 2014 falls, look up the year in the key (above) and the letter shown in **bold** typeface to the right of the year will indicate which of the calendars A–N you should consult. The following list shows on which plates the respective calendars appear.

| Calendar | Plate |
|---|---|
| A and B | 04.011 |
| C and D | 04.012 |
| E and F | 04.013 |
| G and H | 04.014 |
| I and J | 04.015 |
| K and L | 04.016 |
| M and N | 04.017 |

## Perpetual calendar: 1

### A

| JANUARY | FEBRUARY | MARCH | APRIL |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 3 4 5 6 7 | 1 2 3 4 | 1 2 3 4 | 1 |
| 8 9 10 11 12 13 14 | 5 6 7 8 9 10 11 | 5 6 7 8 9 10 11 | 2 3 4 5 6 7 8 |
| 15 16 17 18 19 20 21 | 12 13 14 15 16 17 18 | 12 13 14 15 16 17 18 | 9 10 11 12 13 14 15 |
| 22 23 24 25 26 27 28 | 19 20 21 22 23 24 25 | 19 20 21 22 23 24 25 | 16 17 18 19 20 21 22 |
| 29 30 31 | 26 27 28 | 26 27 28 29 30 31 | 23 24 25 26 27 28 29 |
| | | | 30 |

| MAY | JUNE | JULY | AUGUST |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 3 4 5 6 | 1 2 3 | 1 | 1 2 3 4 5 |
| 7 8 9 10 11 12 13 | 4 5 6 7 8 9 10 | 2 3 4 5 6 7 8 | 6 7 8 9 10 11 12 |
| 14 15 16 17 18 19 20 | 11 12 13 14 15 16 17 | 9 10 11 12 13 14 15 | 13 14 15 16 17 18 19 |
| 21 22 23 24 25 26 27 | 18 19 20 21 22 23 24 | 16 17 18 19 20 21 22 | 20 21 22 23 24 25 26 |
| 28 29 30 31 | 25 26 27 28 29 30 | 23 24 25 26 27 28 29 | 27 28 29 30 31 |
| | | 30 31 | |

| SEPTEMBER | OCTOBER | NOVEMBER | DECEMBER |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 | 1 2 3 4 5 6 7 | 1 2 3 4 | 1 2 |
| 3 4 5 6 7 8 9 | 8 9 10 11 12 13 14 | 5 6 7 8 9 10 11 | 3 4 5 6 7 8 9 |
| 10 11 12 13 14 15 16 | 15 16 17 18 19 20 21 | 12 13 14 15 16 17 18 | 10 11 12 13 14 15 16 |
| 17 18 19 20 21 22 23 | 22 23 24 25 26 27 28 | 19 20 21 22 23 24 25 | 17 18 19 20 21 22 23 |
| 24 25 26 27 28 29 30 | 29 30 31 | 26 27 28 29 30 | 24 25 26 27 28 29 30 |
| | | | 31 |

1786
1797
1809
1815
1826
1837
1843
1854
1865
1871
1882
1893
1899
1905
1911
1922
1933
1939
1950
1961
1967
1978
1989
1995
2006

### B

| JANUARY | FEBRUARY | MARCH | APRIL |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 3 4 5 6 | 1 2 3 | 1 2 3 | 1 2 3 4 5 6 7 |
| 7 8 9 10 11 12 13 | 4 5 6 7 8 9 10 | 4 5 6 7 8 9 10 | 8 9 10 11 12 13 14 |
| 14 15 16 17 18 19 20 | 11 12 13 14 15 16 17 | 11 12 13 14 15 16 17 | 15 16 17 18 19 20 21 |
| 21 22 23 24 25 26 27 | 18 19 20 21 22 23 24 | 18 19 20 21 22 23 24 | 22 23 24 25 26 27 28 |
| 28 29 30 31 | 25 26 27 28 | 25 26 27 28 29 30 31 | 29 30 |

| MAY | JUNE | JULY | AUGUST |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 3 4 5 | 1 2 | 1 2 3 4 5 6 7 | 1 2 3 4 |
| 6 7 8 9 10 11 12 | 3 4 5 6 7 8 9 | 8 9 10 11 12 13 14 | 5 6 7 8 9 10 11 |
| 13 14 15 16 17 18 19 | 10 11 12 13 14 15 16 | 15 16 17 18 19 20 21 | 12 13 14 15 16 17 18 |
| 20 21 22 23 24 25 26 | 17 18 19 20 21 22 23 | 22 23 24 25 26 27 28 | 19 20 21 22 23 24 25 |
| 27 28 29 30 31 | 24 25 26 27 28 29 30 | 29 30 31 | 26 27 28 29 30 31 |

| SEPTEMBER | OCTOBER | NOVEMBER | DECEMBER |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 | 1 2 3 4 5 6 | 1 2 3 | 1 |
| 2 3 4 5 6 7 8 | 7 8 9 10 11 12 13 | 4 5 6 7 8 9 10 | 2 3 4 5 6 7 8 |
| 9 10 11 12 13 14 15 | 14 15 16 17 18 19 20 | 11 12 13 14 15 16 17 | 9 10 11 12 13 14 15 |
| 16 17 18 19 20 21 22 | 21 22 23 24 25 26 27 | 18 19 20 21 22 23 24 | 16 17 18 19 20 21 22 |
| 23 24 25 26 27 28 29 | 28 29 30 31 | 25 26 27 28 29 30 | 23 24 25 26 27 28 29 |
| 30 | | | 30 31 |

1781
1787
1798
1810
1821
1827
1838
1849
1855
1866
1877
1883
1894
1900
1906
1917
1923
1934
1945
1951
1962
1973
1979
1990
2001
2007

© DIAGRAM

**Perpetual calendar: 2**

04.012

## C

| | | |
|---|---|---|

**JANUARY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

**FEBRUARY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | | |

**MARCH**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | | | | | | |

**APRIL**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | | | | |

**MAY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 31 | |

**JUNE**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | | | | | | |

**JULY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | 31 | | | |

**AUGUST**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 |

**SEPTEMBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | | | | | |

**OCTOBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

**NOVEMBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |

**DECEMBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | 31 | | | | |

Years for C: 1782, 1793, 1799, 1805, 1811, 1822, 1833, 1839, 1850, 1861, 1867, 1878, 1889, 1895, 1901, 1907, 1918, 1929, 1935, 1946, 1957, 1963, 1974, 1985, 1991, 2002, 2013

## D

**JANUARY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 31 | |

**FEBRUARY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | |

**MARCH**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | 31 | | | | | |

**APRIL**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | | | |

**MAY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 |

**JUNE**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | | | | | |

**JULY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

**AUGUST**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | | | | | | |

**SEPTEMBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | | | | |

**OCTOBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 31 | |

**NOVEMBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | | | | | | |

**DECEMBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | 31 | | | |

Years for D: 1783, 1794, 1800, 1806, 1817, 1823, 1834, 1845, 1851, 1862, 1873, 1879, 1890, 1902, 1913, 1919, 1930, 1941, 1947, 1958, 1969, 1975, 1986, 1997, 2003, 2014

©DIAGRAM

## Perpetual calendar: 3

**E**

| JANUARY | FEBRUARY | MARCH | APRIL |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 3 | 1 2 3 4 5 6 7 | 1 2 3 4 5 6 7 | 1 2 3 4 |
| 4 5 6 7 8 9 10 | 8 9 10 11 12 13 14 | 8 9 10 11 12 13 14 | 5 6 7 8 9 10 11 |
| 11 12 13 14 15 16 17 | 15 16 17 18 19 20 21 | 15 16 17 18 19 20 21 | 12 13 14 15 16 17 18 |
| 18 19 20 21 22 23 24 | 22 23 24 25 26 27 28 | 22 23 24 25 26 27 28 | 19 20 21 22 23 24 25 |
| 25 26 27 28 29 30 31 | | 29 30 31 | 26 27 28 29 30 |

| MAY | JUNE | JULY | AUGUST |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 | 1 2 3 4 5 6 | 1 2 3 4 | 1 |
| 3 4 5 6 7 8 9 | 7 8 9 10 11 12 13 | 5 6 7 8 9 10 11 | 2 3 4 5 6 7 8 |
| 10 11 12 13 14 15 16 | 14 15 16 17 18 19 20 | 12 13 14 15 16 17 18 | 9 10 11 12 13 14 15 |
| 17 18 19 20 21 22 23 | 21 22 23 24 25 26 27 | 19 20 21 22 23 24 25 | 16 17 18 19 20 21 22 |
| 24 25 26 27 28 29 30 | 28 29 30 | 26 27 28 29 30 31 | 23 24 25 26 27 28 29 |
| 31 | | | 30 31 |

| SEPTEMBER | OCTOBER | NOVEMBER | DECEMBER |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 3 4 5 | 1 2 3 | 1 2 3 4 5 6 7 | 1 2 3 4 5 |
| 6 7 8 9 10 11 12 | 4 5 6 7 8 9 10 | 8 9 10 11 12 13 14 | 6 7 8 9 10 11 12 |
| 13 14 15 16 17 18 19 | 11 12 13 14 15 16 17 | 15 16 17 18 19 20 21 | 13 14 15 16 17 18 19 |
| 20 21 22 23 24 25 26 | 18 19 20 21 22 23 24 | 22 23 24 25 26 27 28 | 20 21 22 23 24 25 26 |
| 27 28 29 30 | 25 26 27 28 29 30 31 | 29 30 | 27 28 29 30 31 |

1789
1795
1801
1807
1818
1829
1835
1846
1857
1863
1874
1885
1891
1903
1914
1925
1931
1942
1953
1959
1970
1981
1987
1998
2009

**F**

| JANUARY | FEBRUARY | MARCH | APRIL |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 | 1 2 3 4 5 6 | 1 2 3 4 5 6 | 1 2 3 |
| 3 4 5 6 7 8 9 | 7 8 9 10 11 12 13 | 7 8 9 10 11 12 13 | 4 5 6 7 8 9 10 |
| 10 11 12 13 14 15 16 | 14 15 16 17 18 19 20 | 14 15 16 17 18 19 20 | 11 12 13 14 15 16 17 |
| 17 18 19 20 21 22 23 | 21 22 23 24 25 26 27 | 21 22 23 24 25 26 27 | 18 19 20 21 22 23 24 |
| 24 25 26 27 28 29 30 | 28 | 28 29 30 31 | 25 26 27 28 29 30 |
| 31 | | | |

| MAY | JUNE | JULY | AUGUST |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 | 1 2 3 4 5 | 1 2 3 | 1 2 3 4 5 6 7 |
| 2 3 4 5 6 7 8 | 6 7 8 9 10 11 12 | 4 5 6 7 8 9 10 | 8 9 10 11 12 13 14 |
| 9 10 11 12 13 14 15 | 13 14 15 16 17 18 19 | 11 12 13 14 15 16 17 | 15 16 17 18 19 20 21 |
| 16 17 18 19 20 21 22 | 20 21 22 23 24 25 26 | 18 19 20 21 22 23 24 | 22 23 24 25 26 27 28 |
| 23 24 25 26 27 28 29 | 27 28 29 30 | 25 26 27 28 29 30 31 | 29 30 31 |
| 30 31 | | | |

| SEPTEMBER | OCTOBER | NOVEMBER | DECEMBER |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 3 4 | 1 2 | 1 2 3 4 5 6 | 1 2 3 4 |
| 5 6 7 8 9 10 11 | 3 4 5 6 7 8 9 | 7 8 9 10 11 12 13 | 5 6 7 8 9 10 11 |
| 12 13 14 15 16 17 18 | 10 11 12 13 14 15 16 | 14 15 16 17 18 19 20 | 12 13 14 15 16 17 18 |
| 19 20 21 22 23 24 25 | 17 18 19 20 21 22 23 | 21 22 23 24 25 26 27 | 19 20 21 22 23 24 25 |
| 26 27 28 29 30 | 24 25 26 27 28 29 30 | 28 29 30 | 26 27 28 29 30 31 |
| | 31 | | |

1790
1802
1813
1819
1830
1841
1847
1858
1869
1875
1886
1897
1909
1915
1926
1937
1943
1954
1965
1971
1982
1993
1999
2010

## Perpetual calendar: 4

### G

| JANUARY | FEBRUARY | MARCH | APRIL |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 | 1 2 3 4 5 | 1 2 3 4 5 | 1 2 |
| 2 3 4 5 6 7 8 | 6 7 8 9 10 11 12 | 6 7 8 9 10 11 12 | 3 4 5 6 7 8 9 |
| 9 10 11 12 13 14 15 | 13 14 15 16 17 18 19 | 13 14 15 16 17 18 19 | 10 11 12 13 14 15 16 |
| 16 17 18 19 20 21 22 | 20 21 22 23 24 25 26 | 20 21 22 23 24 25 26 | 17 18 19 20 21 22 23 |
| 23 24 25 26 27 28 29 | 27 28 | 27 28 29 30 31 | 24 25 26 27 28 29 30 |
| 30 31 | | | |

| MAY | JUNE | JULY | AUGUST |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 3 4 5 6 7 | 1 2 3 4 | 1 2 | 1 2 3 4 5 6 |
| 8 9 10 11 12 13 14 | 5 6 7 8 9 10 11 | 3 4 5 6 7 8 9 | 7 8 9 10 11 12 13 |
| 15 16 17 18 19 20 21 | 12 13 14 15 16 17 18 | 10 11 12 13 14 15 16 | 14 15 16 17 18 19 20 |
| 22 23 24 25 26 27 28 | 19 20 21 22 23 24 25 | 17 18 19 20 21 22 23 | 21 22 23 24 25 26 27 |
| 29 30 31 | 26 27 28 29 30 | 24 25 26 27 28 29 30 | 28 29 30 31 |
| | | 31 | |

| SEPTEMBER | OCTOBER | NOVEMBER | DECEMBER |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 3 | 1 | 1 2 3 4 5 | 1 2 3 |
| 4 5 6 7 8 9 10 | 2 3 4 5 6 7 8 | 6 7 8 9 10 11 12 | 4 5 6 7 8 9 10 |
| 11 12 13 14 15 16 17 | 9 10 11 12 13 14 15 | 13 14 15 16 17 18 19 | 11 12 13 14 15 16 17 |
| 18 19 20 21 22 23 24 | 16 17 18 19 20 21 22 | 20 21 22 23 24 25 26 | 18 19 20 21 22 23 24 |
| 25 26 27 28 29 30 | 23 24 25 26 27 28 29 | 27 28 29 30 | 25 26 27 28 29 30 31 |
| | 30 31 | | |

1785
1791
1803
1814
1825
1831
1842
1853
1859
1870
1881
1887
1898
1910
1921
1927
1938
1949
1955
1966
1977
1983
1994
2005
2011

### H

| JANUARY | FEBRUARY | MARCH | APRIL |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 3 4 5 6 7 | 1 2 3 4 | 1 2 3 | 1 2 3 4 5 6 7 |
| 8 9 10 11 12 13 14 | 5 6 7 8 9 10 11 | 4 5 6 7 8 9 10 | 8 9 10 11 12 13 14 |
| 15 16 17 18 19 20 21 | 12 13 14 15 16 17 18 | 11 12 13 14 15 16 17 | 15 16 17 18 19 20 21 |
| 22 23 24 25 26 27 28 | 19 20 21 22 23 24 25 | 18 19 20 21 22 23 24 | 22 23 24 25 26 27 28 |
| 29 30 31 | 26 27 28 29 | 25 26 27 28 29 30 31 | 29 30 |

| MAY | JUNE | JULY | AUGUST |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 2 3 4 5 | 1 2 | 1 2 3 4 5 6 7 | 1 2 3 4 |
| 6 7 8 9 10 11 12 | 3 4 5 6 7 8 9 | 8 9 10 11 12 13 14 | 5 6 7 8 9 10 11 |
| 13 14 15 16 17 18 19 | 10 11 12 13 14 15 16 | 15 16 17 18 19 20 21 | 12 13 14 15 16 17 18 |
| 20 21 22 23 24 25 26 | 17 18 19 20 21 22 23 | 22 23 24 25 26 27 28 | 19 20 21 22 23 24 25 |
| 27 28 29 30 31 | 24 25 26 27 28 29 30 | 29 30 31 | 26 27 28 29 30 31 |

| SEPTEMBER | OCTOBER | NOVEMBER | DECEMBER |
|---|---|---|---|
| S M T W T F S | S M T W T F S | S M T W T F S | S M T W T F S |
| 1 | 1 2 3 4 5 6 | 1 2 3 | 1 |
| 2 3 4 5 6 7 8 | 7 8 9 10 11 12 13 | 4 5 6 7 8 9 10 | 2 3 4 5 6 7 8 |
| 9 10 11 12 13 14 15 | 14 15 16 17 18 19 20 | 11 12 13 14 15 16 17 | 9 10 11 12 13 14 15 |
| 16 17 18 19 20 21 22 | 21 22 23 24 25 26 27 | 18 19 20 21 22 23 24 | 16 17 18 19 20 21 22 |
| 23 24 25 26 27 28 29 | 28 29 30 31 | 25 26 27 28 29 30 | 23 24 25 26 27 28 29 |
| 30 | | | 30 31 |

1792
1804
1832
1860
1888
1928
1956
1984
2012

© DIAGRAM

## Perpetual calendar: 5

**I**

| 1816 |
|------|
| 1844 |
| 1872 |
| 1912 |
| 1940 |
| 1968 |
| 1996 |

**JANUARY**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | 31 |   |   |   |

**FEBRUARY**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 |   |   |

**MARCH**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 |   |   |   |   |   |   |

**APRIL**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 |   |   |   |   |

**MAY**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 31 |   |

**JUNE**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 |   |   |   |   |   |   |

**JULY**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | 31 |   |   |   |

**AUGUST**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 |

**SEPTEMBER**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 |   |   |   |   |   |

**OCTOBER**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 |   |   |

**NOVEMBER**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |

**DECEMBER**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | 31 |   |   |   |   |

**J**

| 1788 |
|------|
| 1828 |
| 1856 |
| 1884 |
| 1924 |
| 1952 |
| 1980 |
| 2008 |

**JANUARY**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 |   |   |

**FEBRUARY**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 |   |

**MARCH**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | 31 |   |   |   |   |   |

**APRIL**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 |   |   |   |

**MAY**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 |

**JUNE**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 |   |   |   |   |   |

**JULY**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 |   |   |

**AUGUST**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 |   |   |   |   |   |   |

**SEPTEMBER**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 |   |   |   |   |

**OCTOBER**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 31 |   |

**NOVEMBER**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 |   |   |   |   |   |   |

**DECEMBER**
| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | 31 |   |   |   |

## Perpetual calendar: 6

04.016

**K**

| 1812 |
| 1840 |
| 1868 |
| 1896 |
| 1908 |
| 1936 |
| 1964 |
| 1992 |

**JANUARY**
```
S  M  T  W  T  F  S
         1  2  3  4
 5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30 31
```

**FEBRUARY**
```
S  M  T  W  T  F  S
                  1
 2  3  4  5  6  7  8
 9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
```

**MARCH**
```
S  M  T  W  T  F  S
 1  2  3  4  5  6  7
 8  9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29 30 31
```

**APRIL**
```
S  M  T  W  T  F  S
          1  2  3  4
 5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30
```

**MAY**
```
S  M  T  W  T  F  S
            1  2
 3  4  5  6  7  8  9
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24 25 26 27 28 29 30
31
```

**JUNE**
```
S  M  T  W  T  F  S
    1  2  3  4  5  6
 7  8  9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30
```

**JULY**
```
S  M  T  W  T  F  S
       1  2  3  4
 5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30 31
```

**AUGUST**
```
S  M  T  W  T  F  S
                  1
 2  3  4  5  6  7  8
 9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 31
```

**SEPTEMBER**
```
S  M  T  W  T  F  S
       1  2  3  4  5
 6  7  8  9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 30
```

**OCTOBER**
```
S  M  T  W  T  F  S
             1  2  3
 4  5  6  7  8  9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30 31
```

**NOVEMBER**
```
S  M  T  W  T  F  S
 1  2  3  4  5  6  7
 8  9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29 30
```

**DECEMBER**
```
S  M  T  W  T  F  S
          1  2  3  4  5
 6  7  8  9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 30 31
```

**L**

| 1784 |
| 1824 |
| 1852 |
| 1880 |
| 1920 |
| 1948 |
| 1976 |
| 2004 |

**JANUARY**
```
S  M  T  W  T  F  S
                1  2  3
 4  5  6  7  8  9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30 31
```

**FEBRUARY**
```
S  M  T  W  T  F  S
 1  2  3  4  5  6  7
 8  9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29
```

**MARCH**
```
S  M  T  W  T  F  S
    1  2  3  4  5  6
 7  8  9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30 31
```

**APRIL**
```
S  M  T  W  T  F  S
             1  2  3
 4  5  6  7  8  9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30
```

**MAY**
```
S  M  T  W  T  F  S
                  1
 2  3  4  5  6  7  8
 9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 31
```

**JUNE**
```
S  M  T  W  T  F  S
       1  2  3  4  5
 6  7  8  9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 30
```

**JULY**
```
S  M  T  W  T  F  S
             1  2  3
 4  5  6  7  8  9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30 31
```

**AUGUST**
```
S  M  T  W  T  F  S
 1  2  3  4  5  6  7
 8  9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29 30 31
```

**SEPTEMBER**
```
S  M  T  W  T  F  S
          1  2  3  4
 5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30
```

**OCTOBER**
```
S  M  T  W  T  F  S
                1  2
 3  4  5  6  7  8  9
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24 25 26 27 28 29 30
31
```

**NOVEMBER**
```
S  M  T  W  T  F  S
    1  2  3  4  5  6
 7  8  9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30
```

**DECEMBER**
```
S  M  T  W  T  F  S
             1  2  3  4
 5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30 31
```

©DIAGRAM

## Perpetual calendar: 7

**M**

| 1796 |
|------|
| 1808 |
| 1836 |
| 1864 |
| 1892 |
| 1904 |
| 1932 |
| 1960 |
| 1988 |

**JANUARY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 |

**FEBRUARY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 |

**MARCH**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 |

**APRIL**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |

**MAY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | 31 |

**JUNE**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 |

**JULY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 |

**AUGUST**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | 31 |

**SEPTEMBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 |

**OCTOBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | 31 |

**NOVEMBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 |

**DECEMBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 |

**N**

| 1780 |
|------|
| 1820 |
| 1848 |
| 1876 |
| 1916 |
| 1944 |
| 1972 |
| 2000 |

**JANUARY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | 31 |

**FEBRUARY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 |

**MARCH**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 31 |

**APRIL**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 |

**MAY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 29 | 30 | 31 |

**JUNE**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 |

**JULY**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   |   | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | 31 |

**AUGUST**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 |

**SEPTEMBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |

**OCTOBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | 31 |

**NOVEMBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 |

**DECEMBER**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
|   |   |   |   |   | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 |

## Multiplication table

|    | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9   | 10  | 11  | 12  |
|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| 1  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9   | 10  | 11  | 12  |
| 2  | 2  | 4  | 6  | 8  | 10 | 12 | 14 | 16 | 18  | 20  | 22  | 24  |
| 3  | 3  | 6  | 9  | 12 | 15 | 18 | 21 | 24 | 27  | 30  | 33  | 36  |
| 4  | 4  | 8  | 12 | 16 | 20 | 24 | 28 | 32 | 36  | 40  | 44  | 48  |
| 5  | 5  | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45  | 50  | 55  | 60  |
| 6  | 6  | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54  | 60  | 66  | 72  |
| 7  | 7  | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63  | 70  | 77  | 84  |
| 8  | 8  | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72  | 80  | 88  | 96  |
| 9  | 9  | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81  | 90  | 99  | 108 |
| 10 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90  | 100 | 110 | 120 |
| 11 | 11 | 22 | 33 | 44 | 55 | 66 | 77 | 88 | 99  | 110 | 121 | 132 |
| 12 | 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 |

©DIAGRAM

To multiply two factors together, find the first factor in the
left-hand column. Follow the row of figures across the
table until it crosses the column headed by the second
factor. The number at the point where the row and
column cross is the product of the two factors.

## Percentage equivalents of fractions

| | | | % | | | | % |
|---|---|---|---|---|---|---|---|
| | | 1/64 | 1.5625 | | | 33/64 | 51.5625 |
| | 1/32 | | 3.125 | | 17/32 | | 53.125 |
| | | 3/64 | 4.6875 | | | 35/64 | 54.6875 |
| 1/16 | | | 6.25 | 9/16 | | | 56.25 |
| | | 5/64 | 7.8125 | | | 37/64 | 57.8125 |
| | 3/32 | | 9.375 | | 19/32 | | 59.375 |
| | | 7/64 | 10.9375 | | | 39/64 | 60.9375 |
| 1/8 | | | 12.5 | 5/8 | | | 62.5 |
| | | 9/64 | 14.0625 | | | 41/64 | 64.0625 |
| | 5/32 | | 15.625 | | 21/32 | | 65.625 |
| | | 11/64 | 17.1875 | | | 43/64 | 67.1875 |
| 3/16 | | | 18.75 | 11/16 | | | 68.75 |
| | | 13/64 | 20.3125 | | | 45/64 | 70.3125 |
| | 7/32 | | 21.875 | | 23/32 | | 71.875 |
| | | 15/64 | 23.4375 | | | 47/64 | 73.4375 |
| 1/4 | | | 25 | 3/4 | | | 75 |
| | | 17/64 | 26.5625 | | | 49/64 | 76.5625 |
| | 9/32 | | 28.125 | | 25/32 | | 78.125 |
| | | 19/64 | 29.6875 | | | 51/64 | 79.6875 |
| 5/16 | | | 31.25 | 13/16 | | | 81.25 |
| | | 21/64 | 32.8125 | | | 53/64 | 82.8125 |
| | 11/32 | | 34.375 | | 27/32 | | 84.375 |
| | | 23/64 | 35.9375 | | | 55/64 | 85.9375 |
| 3/8 | | | 37.5 | 7/8 | | | 87.5 |
| | | 25/64 | 39.0625 | | | 57/64 | 89.0625 |
| | 13/32 | | 40.625 | | 29/32 | | 90.625 |
| | | 27/64 | 42.1875 | | | 59/64 | 92.1875 |
| 7/16 | | | 43.75 | 15/16 | | | 93.75 |
| | | 29/64 | 45.3125 | | | 61/64 | 95.3125 |
| | 15/32 | | 46.875 | | 31/32 | | 96.875 |
| | | 31/64 | 48.4375 | | | 63/64 | 98.4375 |
| 1/2 | | | 50 | 1 | | | 100 |

## Fractional equivalents of percentages

| % | | | | | | | |
|-----|---|---|---|---|---|---|---|
| 1 | | | | | | | $1/100$ |
| 2 | | | | | | $1/50$ | |
| 3 | | | | | | | $3/100$ |
| 4 | | | | | | $1/25$ | |
| 5 | | | | | $1/20$ | | |
| 6 | | | | | | $3/50$ | |
| 7 | | | | | | | $7/100$ |
| 8 | | | | | | $2/25$ | |
| 9 | | | | | | | $9/100$ |
| 10 | | | | $1/10$ | | | |
| 15 | | | | | $3/20$ | | |
| 20 | | | $1/5$ | | | | |
| 25 | | $1/4$ | | | | | |
| 30 | | | | $3/10$ | | | |
| 35 | | | | | $7/20$ | | |
| 40 | | | $2/5$ | | | | |
| 45 | | | | | $9/20$ | | |
| 50 | $1/2$ | | | | | | |
| 55 | | | | | $11/20$ | | |
| 60 | | | $3/5$ | | | | |
| 65 | | | | | $13/20$ | | |
| 70 | | | | $7/10$ | | | |
| 75 | | $3/4$ | | | | | |
| 80 | | | $4/5$ | | | | |
| 85 | | | | | $17/20$ | | |
| 90 | | | | $9/10$ | | | |
| 95 | | | | | $19/20$ | | |
| 100 | 1 | | | | | | |

# Fraction/decimal conversion values

| 1/16 | 1/32 | 1/64 | Decimal | | 1/16 | 1/32 | 1/64 | Decimal |
|---|---|---|---|---|---|---|---|---|
| | | 1/64 | 0·015 625 | | | | 33/64 | 0·515 625 |
| | 1/32 | | 0·031 25 | | | 17/32 | | 0·531 25 |
| | | 3/64 | 0·046 875 | | | | 35/64 | 0·546 875 |
| 1/16 | | | 0·062 5 | | 9/16 | | | 0·562 5 |
| | | 5/64 | 0·078 125 | | | | 37/64 | 0·578 125 |
| | 3/32 | | 0·093 75 | | | 19/32 | | 0·593 75 |
| | | 7/64 | 0·109 375 | | | | 39/64 | 0·609 375 |
| 1/8 | | | 0·125 | | 5/8 | | | 0·625 |
| | | 9/64 | 0·140 625 | | | | 41/64 | 0·640 625 |
| | 5/32 | | 0·156 25 | | | 21/32 | | 0·656 25 |
| | | 11/64 | 0·171 875 | | | | 43/64 | 0·671 875 |
| 3/16 | | | 0·187 5 | | 11/16 | | | 0·687 5 |
| | | 13/64 | 0·203 125 | | | | 45/64 | 0·703 125 |
| | 7/32 | | 0·218 75 | | | 23/32 | | 0·718 75 |
| | | 15/64 | 0·234 375 | | | | 47/64 | 0·734 375 |
| 1/4 | | | 0·25 | | 3/4 | | | 0·75 |
| | | 17/64 | 0·265 625 | | | | 49/64 | 0·765 625 |
| | 9/32 | | 0·281 25 | | | 25/32 | | 0·781 25 |
| | | 19/64 | 0·296 875 | | | | 51/64 | 0·796 875 |
| 5/16 | | | 0·312 5 | | 13/16 | | | 0·812 5 |
| | | 21/64 | 0·328 125 | | | | 53/64 | 0·828 125 |
| | 11/32 | | 0·343 75 | | | 27/32 | | 0·843 75 |
| | | 23/64 | 0·359 375 | | | | 55/64 | 0·859 375 |
| 3/8 | | | 0·375 | | 7/8 | | | 0·875 |
| | | 25/64 | 0·390 625 | | | | 57/64 | 0·890 625 |
| | 13/32 | | 0·406 25 | | | 29/32 | | 0·906 25 |
| | | 27/64 | 0·421 875 | | | | 59/64 | 0·921 875 |
| 7/16 | | | 0·437 5 | | 15/16 | | | 0·937 5 |
| | | 29/64 | 0·453 125 | | | | 61/64 | 0·953 125 |
| | 15/32 | | 0·468 75 | | | 31/32 | | 0·968 75 |
| | | 31/64 | 0·484 375 | | | | 63/64 | 0·984 375 |
| 1/2 | | | 0·5 | | 1 | | | 1·0 |

©DIAGRAM

## Compound interest on annual basis

| Years | 4% | 5% | 6% | 7% | 8% | 9% | 10% | 12% | 14% | 16% |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.00 | 5.00 | 6.00 | 7.00 | 8.00 | 9.00 | 10.00 | 12.00 | 14.00 | 16.00 |
| 2 | 8.16 | 10.25 | 12.36 | 14.49 | 16.64 | 18.81 | 21.00 | 25.44 | 29.96 | 34.56 |
| 3 | 12.49 | 15.76 | 19.10 | 22.50 | 25.97 | 29.50 | 33.10 | 40.49 | 48.15 | 56.09 |
| 4 | 16.99 | 21.55 | 26.25 | 31.08 | 36.05 | 41.16 | 46.41 | 57.35 | 68.90 | 81.06 |
| 5 | 21.67 | 27.63 | 33.82 | 40.26 | 46.93 | 53.86 | 61.05 | 76.23 | 92.54 | 110.03 |
| 6 | 26.53 | 34.01 | 41.85 | 50.07 | 58.69 | 67.71 | 77.16 | 97.38 | 119.50 | 143.64 |
| 7 | 31.59 | 40.71 | 50.36 | 60.58 | 71.38 | 82.80 | 94.87 | 121.07 | 150.23 | 182.62 |
| 8 | 36.86 | 47.75 | 59.38 | 71.82 | 85.09 | 99.26 | 114.36 | 147.60 | 185.26 | 227.84 |
| 9 | 42.33 | 55.13 | 68.95 | 83.85 | 99.90 | 117.19 | 135.79 | 177.31 | 225.19 | 280.30 |
| 10 | 48.02 | 62.89 | 79.08 | 96.72 | 115.89 | 136.74 | 159.37 | 210.58 | 270.72 | 341.14 |
| 12 | 60.10 | 79.59 | 101.22 | 125.22 | 151.82 | 181.27 | 213.84 | 289.60 | 381.79 | 493.60 |
| 15 | 80.09 | 107.89 | 139.66 | 175.90 | 217.22 | 264.25 | 317.72 | 447.36 | 613.79 | 826.55 |
| 20 | 119.11 | 165.33 | 220.71 | 286.97 | 366.10 | 460.44 | 572.75 | 864.63 | 1,274.35 | 1,846.08 |

©DIAGRAM

## Simple interest tables

|  | 2½% | 3% | 3½% | 4% | 4½% | 5% | 5½% | 6% |
|---|---|---|---|---|---|---|---|---|
| 1 day | 0·069 | 0·083 | 0·097 | 0·111 | 0·125 | 0·139 | 0·153 | 0·167 |
| 2 days | 0·139 | 0·167 | 0·194 | 0·222 | 0·250 | 0·278 | 0·306 | 0·333 |
| 3 days | 0·208 | 0·250 | 0·292 | 0·333 | 0·375 | 0·417 | 0·458 | 0·500 |
| 4 days | 0·278 | 0·333 | 0·389 | 0·444 | 0·500 | 0·556 | 0·611 | 0·667 |
| 5 days | 0·347 | 0·417 | 0·486 | 0·556 | 0·625 | 0·694 | 0·764 | 0·833 |
| 6 days | 0·417 | 0·500 | 0·583 | 0·667 | 0·750 | 0·833 | 0·917 | 1·000 |
| 30 days | 2·083 | 2·500 | 2·917 | 3·333 | 3·750 | 4·167 | 4·583 | 5·000 |
| 60 days | 4·167 | 5·000 | 5·833 | 6·667 | 7·500 | 8·333 | 9·167 | 10·000 |
| 90 days | 6·250 | 7·500 | 8·750 | 10·000 | 11·250 | 12·500 | 13·750 | 15·000 |
| 180 days | 12·500 | 15·000 | 17·500 | 20·000 | 22·500 | 25·000 | 27·500 | 30·000 |
| 360 days | 25·000 | 30·000 | 35·000 | 40·000 | 45·000 | 50·000 | 55·000 | 60·000 |

©DIAGRAM

**Root values**

| | $\sqrt{\phantom{x}}$ | $\sqrt[3]{\phantom{x}}$ | | $\sqrt{\phantom{x}}$ | $\sqrt[3]{\phantom{x}}$ | | $\sqrt{\phantom{x}}$ | $\sqrt[3]{\phantom{x}}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 1·000 | 1·000 | 35 | 5·916 | 3·271 | 69 | 8·306 | 4·101 |
| 2 | 1·414 | 1·259 | 36 | 6·000 | 3·301 | 70 | 8·366 | 4·121 |
| 3 | 1·732 | 1·442 | 37 | 6·082 | 3·332 | 71 | 8·426 | 4·140 |
| 4 | 2·000 | 1·587 | 38 | 6·164 | 3·362 | 72 | 8·485 | 4·160 |
| 5 | 2·236 | 1·710 | 39 | 6·245 | 3·391 | 73 | 8·544 | 4·179 |
| 6 | 2·449 | 1·817 | 40 | 6·324 | 3·420 | 74 | 8·602 | 4·198 |
| 7 | 2·645 | 1·913 | 41 | 6·403 | 3·448 | 75 | 8·660 | 4·217 |
| 8 | 2·828 | 2·000 | 42 | 6·480 | 3·476 | 76 | 8·717 | 4·235 |
| 9 | 3·000 | 2·080 | 43 | 6·557 | 3·503 | 77 | 8·775 | 4·254 |
| 10 | 3·162 | 2·154 | 44 | 6·633 | 3·530 | 78 | 8·831 | 4·272 |
| 11 | 3·316 | 2·224 | 45 | 6·708 | 3·556 | 79 | 8·888 | 4·290 |
| 12 | 3·464 | 2·289 | 46 | 6·782 | 3·583 | 80 | 8·944 | 4·308 |
| 13 | 3·605 | 2·351 | 47 | 6·855 | 3·608 | 81 | 9·000 | 4·326 |
| 14 | 3·741 | 2·410 | 48 | 6·928 | 3·634 | 82 | 9·055 | 4·344 |
| 15 | 3·873 | 2·466 | 49 | 7·000 | 3·659 | 83 | 9·110 | 4·362 |
| 16 | 4·000 | 2·519 | 50 | 7·071 | 3·684 | 84 | 9·165 | 4·379 |
| 17 | 4·123 | 2·571 | 51 | 7·141 | 3·708 | 85 | 9·219 | 4·396 |
| 18 | 4·242 | 2·620 | 52 | 7·211 | 3·732 | 86 | 9·273 | 4·414 |
| 19 | 4·358 | 2·668 | 53 | 7·280 | 3·756 | 87 | 9·327 | 4·431 |
| 20 | 4·472 | 2·714 | 54 | 7·348 | 3·779 | 88 | 9·380 | 4·448 |
| 21 | 4·582 | 2·758 | 55 | 7·416 | 3·803 | 89 | 9·434 | 4·464 |
| 22 | 4·690 | 2·802 | 56 | 7·483 | 3·825 | 90 | 9·486 | 4·481 |
| 23 | 4·795 | 2·843 | 57 | 7·549 | 3·848 | 91 | 9·539 | 4·497 |
| 24 | 4·899 | 2·884 | 58 | 7·615 | 3·870 | 92 | 9·591 | 4·514 |
| 25 | 5·000 | 2·924 | 59 | 7·681 | 3·893 | 93 | 9·643 | 4·530 |
| 26 | 5·099 | 2·962 | 60 | 7·746 | 3·914 | 94 | 9·695 | 4·546 |
| 27 | 5·196 | 3·000 | 61 | 7·810 | 3·936 | 95 | 9·746 | 4·562 |
| 28 | 5·291 | 3·036 | 62 | 7·874 | 3·957 | 96 | 9·798 | 4·578 |
| 29 | 5·385 | 3·072 | 63 | 7·937 | 3·979 | 97 | 9·848 | 4·594 |
| 30 | 5·477 | 3·107 | 64 | 8·000 | 4·000 | 98 | 9·899 | 4·610 |
| 31 | 5·567 | 3·141 | 65 | 8·062 | 4·020 | 99 | 9·949 | 4·626 |
| 32 | 5·656 | 3·174 | 66 | 8·124 | 4·041 | 100 | 10·000 | 4·641 |
| 33 | 5·744 | 3·207 | 67 | 8·185 | 4·061 | | | |
| 34 | 5·831 | 3·239 | 68 | 8·246 | 4·081 | | | |

© DIAGRAM

## Conversion table: length
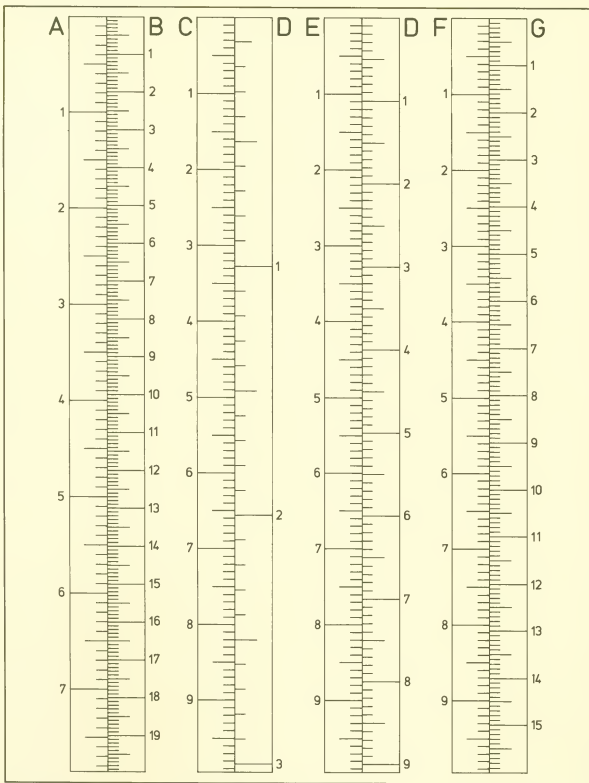
A Inches
B Centimeters
C Feet
D Meters
E Yards
F Miles
G Kilometers

1 inch = 2·5400 centimeters
1 centimeter = 0·3937 inch
1 foot = 0·3048 meter
1 meter = 3·2808 feet
1 yard = 0·9144 meter
1 meter = 1·0936 yards
1 mile = 1·6093 kilometers
1 kilometer = 0·6214 mile

©DIAGRAM

## Conversion table: area
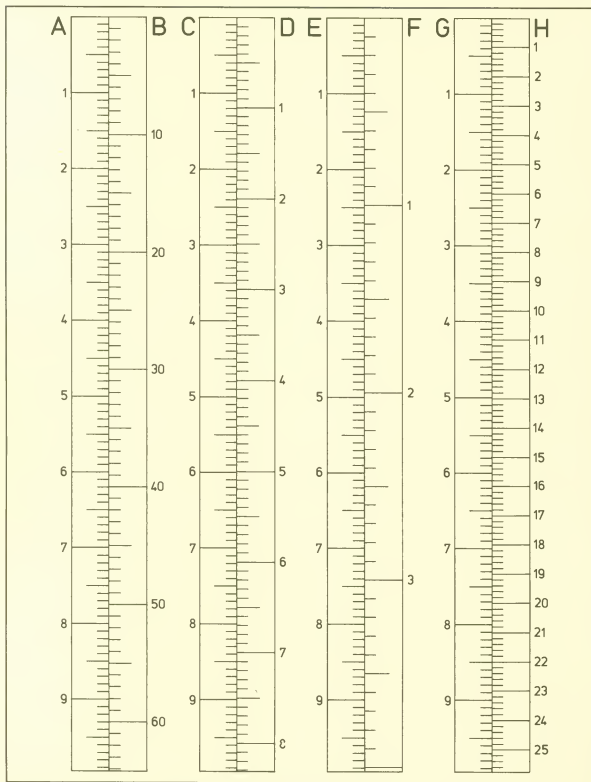
A Square inches     1 square inch = 6·4516 square centimeters
B Square centimeters     1 square centimeter = 0·1550 inch
C Square yards     1 square yard = 0·8361 square meter
D Square meters     1 square meter = 1·1960 square yards
E Acres     1 acre = 0·4047 hectare
F Hectares     1 hectare = 2·4710 acres
G Square miles     1 square mile = 2·5900 square kilometers
H Square kilometers     1 square kilometer = 0·3861 square mile

©DIAGRAM

## Conversion table: volume

A Cubic inches
B Cubic centimeters
C Cubic feet
D Cubic meters

1 cubic inch = 16·387 cubic centimeters
1 cubic centimeter = 0·0610 cubic inch
1 cubic foot = 0·0283 cubic meter
1 cubic meter = 35·315 cubic feet

© DIAGRAM
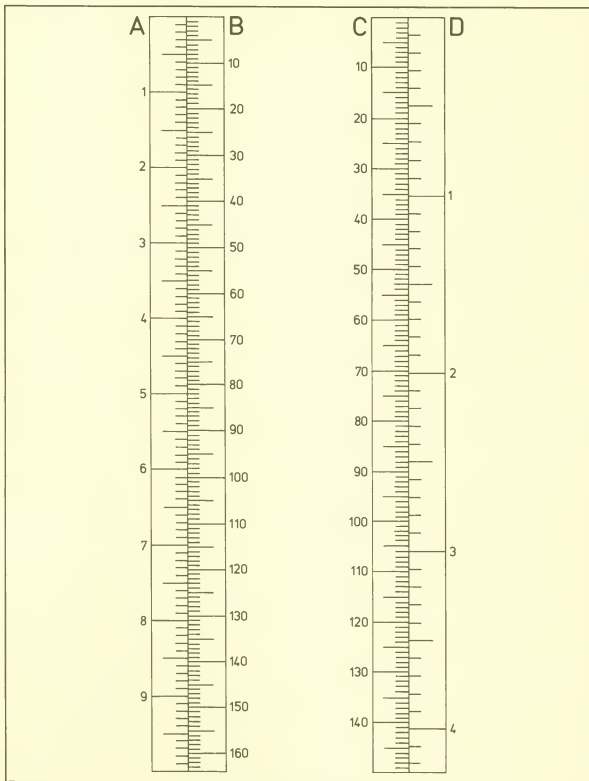
## Conversion table: weight 1
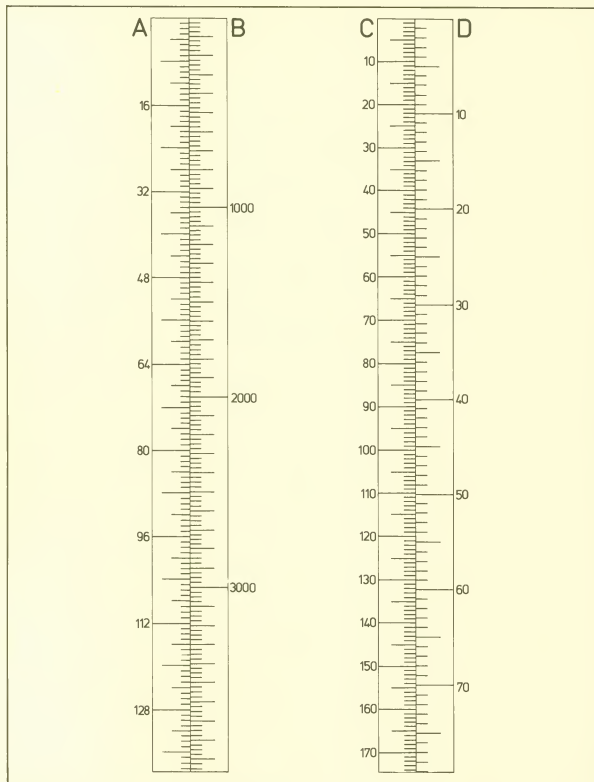
A Ounces
B Grams
C Pounds
D Kilograms

1 ounce = 28·350 grams
1 gram = 0·0353 ounce
1 pound = 0·4536 kilogram
1 kilogram = 2·2046 pounds

©DIAGRAM

## Conversion table: weight 2
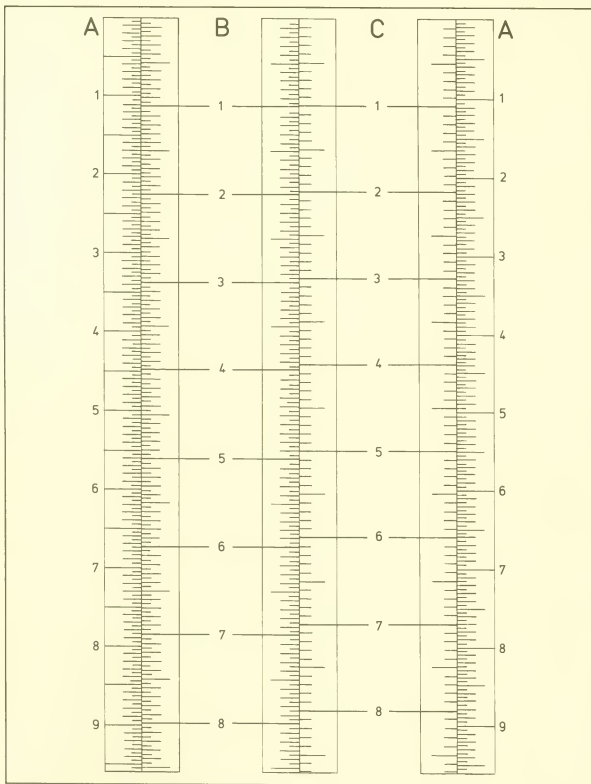
A Tons (US)
B Tons (UK)
C Tonnes

1 ton (US) = 0·89286 ton (UK)
1 ton (US) = 0·907194 tonne
1 ton (UK) = 1·12 tons (US)
1 ton (UK) = 1·01606 tonnes
1 tonne = 1·1023 tons (US)
1 tonne = 0·984197 ton (UK)

## Conversion table: liquid 1

| A | B | C | A |
|---|---|---|---|
| 4 | 5 | 20 | 4 |
| 8 | 10 | 30 | 8 |
| 12 | 15 | 40 | 12 |
| 16 | 20 | 50 | 16 |
| 20 | 25 | 60 | 20 |
| 24 | 30 | 70 | 24 |
| 28 | 35 | 80 | 28 |
| 32 | | 90 | 32 |
| 36 | 40 | 100 | 36 |
| 40 | 45 | 110 | 40 |
| 44 | 50 | 120 | 44 |
| 48 | 55 | 130 | 48 |
| 52 | | 140 | 52 |
| 56 | 60 | 150 | 56 |
| 60 | 65 | 160 | 60 |
| 64 | 70 | 170 | 64 |
| 68 | 75 | 180 | 68 |
| 72 | 80 | 190 | 72 |
| 76 | 85 | 200 | 76 |
| 80 | | 210 | 80 |
| 84 | 90 | 220 | 84 |
| 88 | 95 | 230 | 88 |
| 92 | 100 | 240 | 92 |
| 96 | 105 | 250 | 96 |
| 100 | 110 | 260 | 100 |
| 104 | 115 | 270 | 104 |
| 108 | 120 | 280 | 108 |
| 112 | 125 | 290 | 112 |
| 116 | 130 | 300 | 116 |
| 120 | 135 | 310 | 120 |
| 124 | 140 | 320 | 124 |
| 128 | | 330 | 128 |
| 132 | | 340 | 132 |
| 136 | | 350 | 136 |
| | | 360 | |
| | | 370 | |
| | | 380 | |
| | | 390 | |
| | | 400 | |
| | | 410 | |

A  Fluid ounces (US)
B  Fluid ounces (UK)
C  Centiliters

1 fluid ounce (US) = 1·0408 fluid ounces (UK)
1 fluid ounce (US) = 2·9573 centiliters
1 fluid ounce (UK) = 0·9608 fluid ounce (US)
1 fluid ounce (UK) = 2·8413 centiliters
1 centiliter = 0·3381 fluid ounce (US)
1 centiliter = 0·3520 fluid ounce (UK)

©DIAGRAM

**Conversion table: liquid 2**
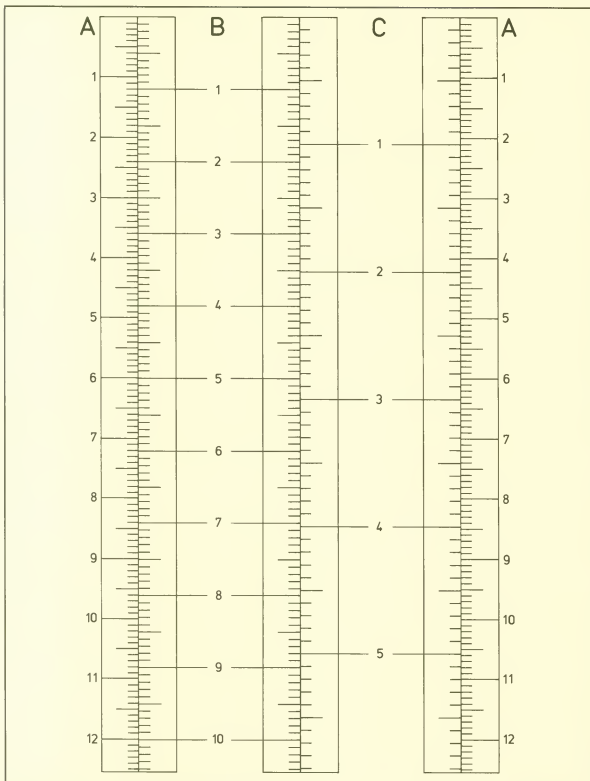
A Pints (US)
B Pints (UK)
C Liters

1 pint (US) = 0·8327 pint (UK)
1 pint (US) = 0·4732 liter
1 pint (UK) = 1·2010 pints (US)
1 pint (UK) = 0·5683 liter
1 liter = 2·1134 pints (US)
1 liter = 1·7598 pints (UK)

## Conversion table: liquid 3
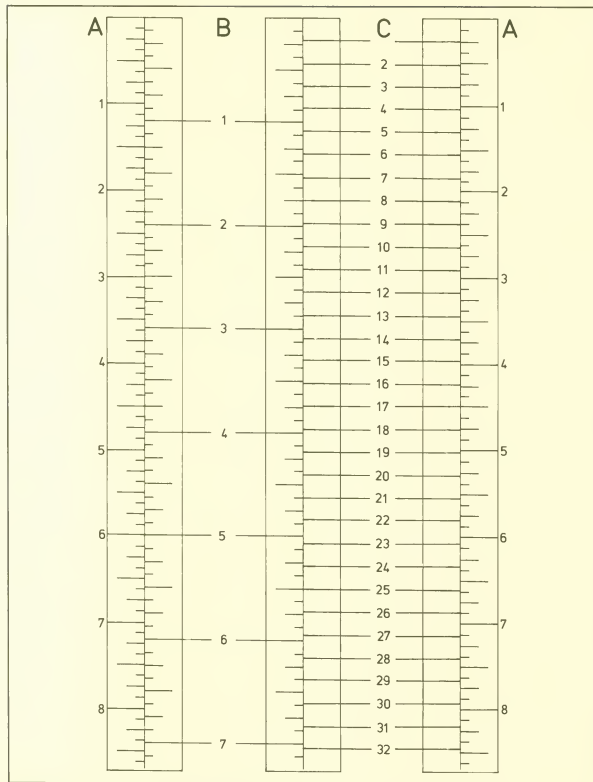
A Gallons (US)
B Gallons (UK)
C Liters

1 gallon (US) = 0·8327 gallon (UK)
1 gallon (US) = 3·7853 liters
1 gallon (UK) = 1·2009 gallons (US)
1 gallon (UK) = 4·5460 liters
1 liter = 0·2642 gallon (US)
1 liter = 0·2200 gallon (UK)

©DIAGRAM

## Conversion table: temperature

**Thermometer reading equivalents**
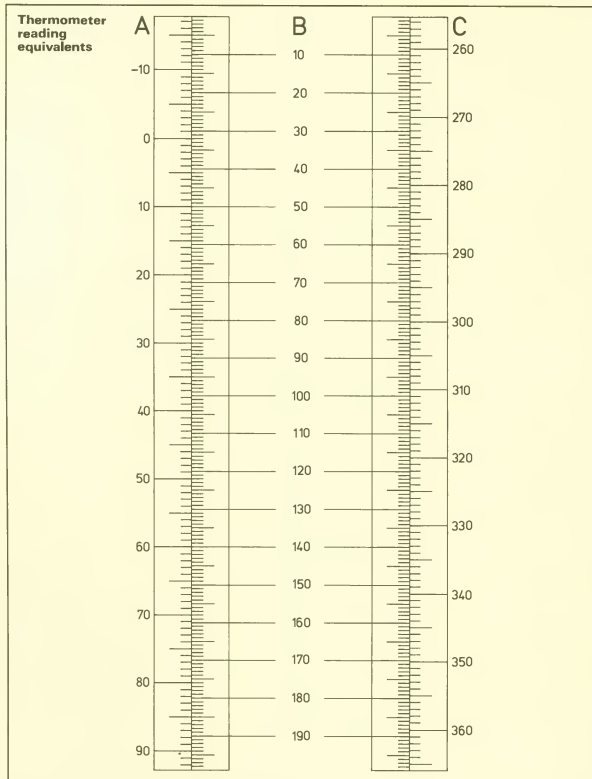


A Celsius
B Fahrenheit
C Kelvin

1° Celsius = 33·8° Fahrenheit
1° Celsius = 274·16° Kelvin
1° Fahrenheit = −17·22° Celsius
1° Fahrenheit = 255·93° Kelvin
1° Kelvin = −272·16° Celsius
1° Kelvin = −457·87° Fahrenheit

©DIAGRAM

## Conversion table: speed
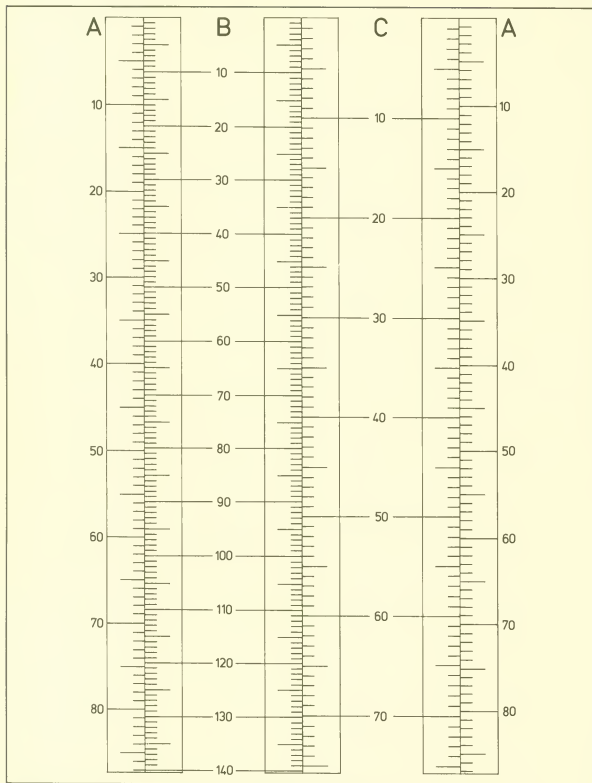
A Miles per hour
B Kilometers per hour
C Knots per hour

1 mile per hour = 1·6093 kilometers per hour
1 mile per hour = 0·86897 knot per hour
1 kilometer per hour = 0·6214 mile per hour
1 kilometer per hour = 0·53997 knot per hour
1 knot per hour = 1·1507823 miles per hour
1 knot per hour = 1·852 kilometers per hour

©DIAGRAM

## Circles

**Area of circle**

$AB$ = diameter, $CD$ = radius

$$\text{Area} = \pi \, (\text{radius})^2 = \frac{\pi \, (\text{diameter})^2}{4}$$

Circumference = $\pi$ (diameter)

$C = 2\pi \, (\text{radius})$

$$\frac{\text{arc } BC}{\text{circumference}} = \frac{\text{angle } BDC}{360°}$$

$$1 \text{ radian} = \frac{180°}{\pi} = 57.2958°$$

**Area of sector**

$$\text{Area} = \frac{(\text{arc } AB) \, (\text{radius})}{2}$$

$$= \pi \, \frac{(\text{radius})^2 \, (\text{angle } ACB)}{360°}$$

$$= \frac{(\text{radius})^2 \, (\text{angle } ACB \text{ in radians})}{2}$$

**Area of segment**

$$\text{Area} = \frac{(\text{radius})^2}{2} \left[ \frac{\pi (\text{angle } ACB°)}{180} - \sin ACB° \right]$$

$$\text{Area} = \frac{(\text{radius})^2}{2} \left[ \text{angle } ACB \text{ in radians} - \sin ACB° \right]$$

Area = area of sector $ACB$ − area of triangle $ABC$
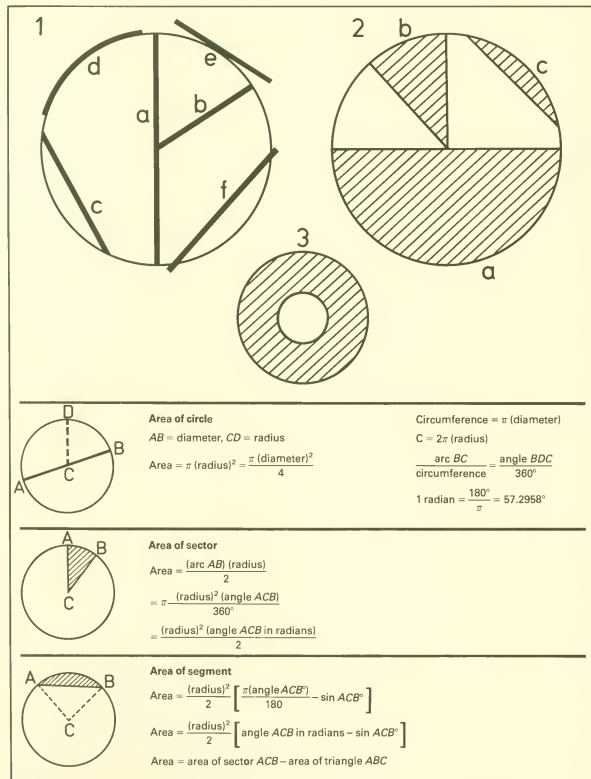
1 Lines
1a Diameter
1b Radius
1c Chord
1d Arc
1e Tangent

1f Secant
2 Spaces
2a Semicircle
2b Sector
2c Segment
3 Annulus

© DIAGRAM

## Angles: degrees
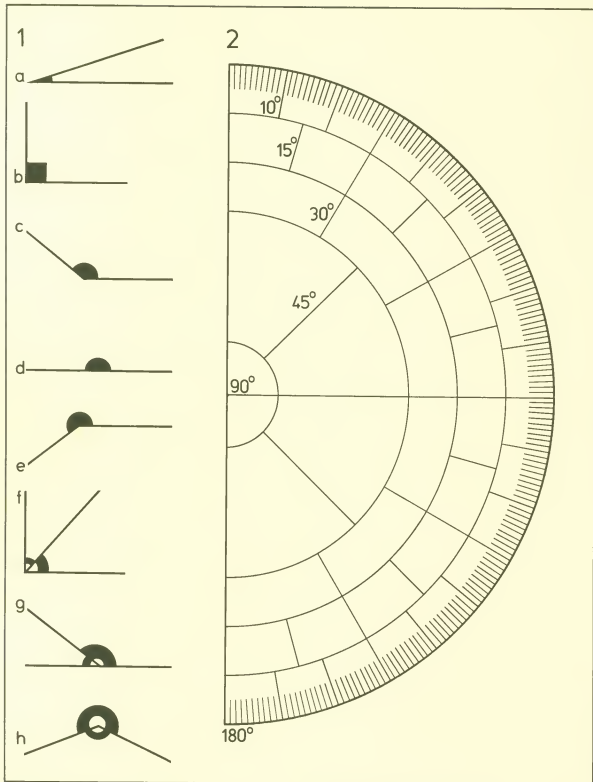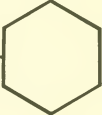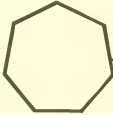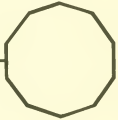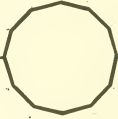
**1** Names of angles
**a** Acute: more than 0° less than 90°
**b** Right: 90°
**c** Obtuse: more than 90° less than 180°
**d** Straight: 180°
**e** Reflex: more than 180° less than 360°
**f** Complementary: two angles whose sum is 90°
**g** Supplementary: two angles whose sum is 180°
**h** Conjugate: two angles whose sum is 360°

**2** Degrees: subdivision of half circle

©DIAGRAM

## Regular polygons

| ODD NUMBER OF SIDES | NAME | INTERNAL ANGLE | SUM OF INTERNAL ANGLES | EVEN NUMBER OF SIDES |
|---|---|---|---|---|
| | Triangle | 60° | 180° | |
| | Square | 90° | 360° | |
| | Pentagon | 108° | 540° | |
| | Hexagon | 120° | 720° | |
| | Heptagon | 128.6° | 900° | |
| | Octagon | 135° | 1080° | |
| | Nonagon | 140° | 1260° | |
| | Decagon | 144° | 1440° | |
| | Undecagon | 147.3° | 1620° | |
| | Dodecagon | 150° | 1800° | |

©DIAGRAM

## Triangles and quadrilaterals
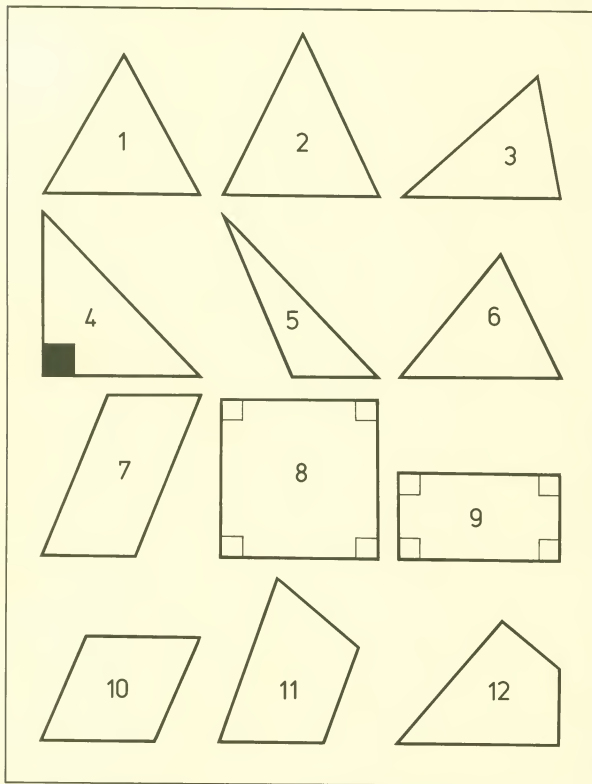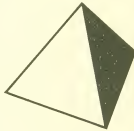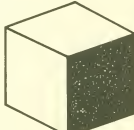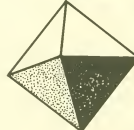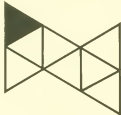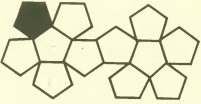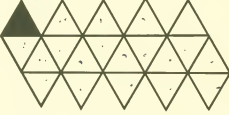
1 Equilateral triangle: all sides equal
2 Isosceles triangle: two sides equal
3 Scalene triangle: no sides equal
4 Right-angled triangle: one right angle
5 Obtuse-angled triangle: one obtuse angle
6 Acute-angled triangle: three acute angles
7 Parallelogram: opposite sides equal
8 Square: equal sides and angles
9 Rectangle: opposite sides and angles equal
10 Rhombus: equal sides but no right angles

11 Trapezium: two parallel sides
12 Irregular quadrilateral: no parallel sides

©DIAGRAM

## Regular solids

| TYPE OF SOLID | NUMBER OF FACES | REGULAR POLYGONS |
|---|---|---|
| Tetrahedron | 4 | Equilateral triangles |
| Cube | 6 | Squares |
| Octahedron | 8 | Equilateral triangles |
| Dodecahedron | 12 | Pentagons |
| Icosahedron | 20 | Equilateral triangles |

© DIAGRAM

All faces of a regular solid are identical polygons of equal size

## Semi-regular solids
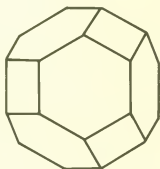
Truncated octahedron

14 faces; squares and hexagons

Cuboctahedron

14 faces; triangles and squares
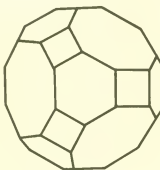
Truncated cuboctahedron

26 faces; squares, hexagons and octagons

Truncated icosahedron

32 faces; pentagons and hexagons
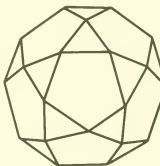
Icosidodecahedron

32 faces; triangles and pentagons

Truncated icosidodecahedron

62 faces; squares, hexagons and decagons

©DIAGRAM

## Non-regular solids
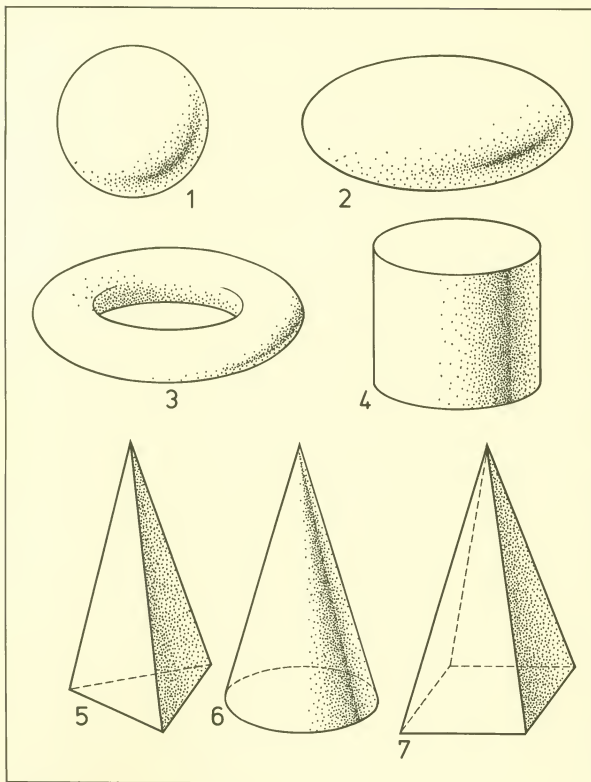
1 Sphere
2 Spheroid
3 Torus
4 Cylinder
5 Triangular prism
6 Cone
7 Square-based pyramid

## Solids: calculating volume
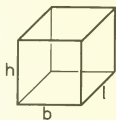
**Cube or cuboid**

$$\text{volume} = \text{breadth} \times \text{height} \times \text{length}$$
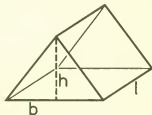
**Prism**

$$\text{volume} = \frac{\text{breadth} \times \text{height} \times \text{length}}{2}$$
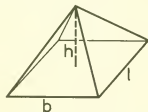
**Pyramid**

$$\text{volume} = \frac{\text{breadth} \times \text{height} \times \text{length}}{3}$$

**Cylinder**

$$\text{volume} = 3{\cdot}1416 \times \text{radius}^2 \times \text{length}$$

**Cone**

$$\text{volume} = \frac{3{\cdot}1416 \times \text{radius}^2 \times \text{height}}{3}$$
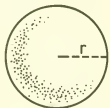
**Sphere**

$$\text{volume} = \frac{4 \times 3{\cdot}1416 \times \text{radius}^3}{3}$$

©DIAGRAM

b = Breadth
h = Height
l = Length
r = Radius
π = 3.1416
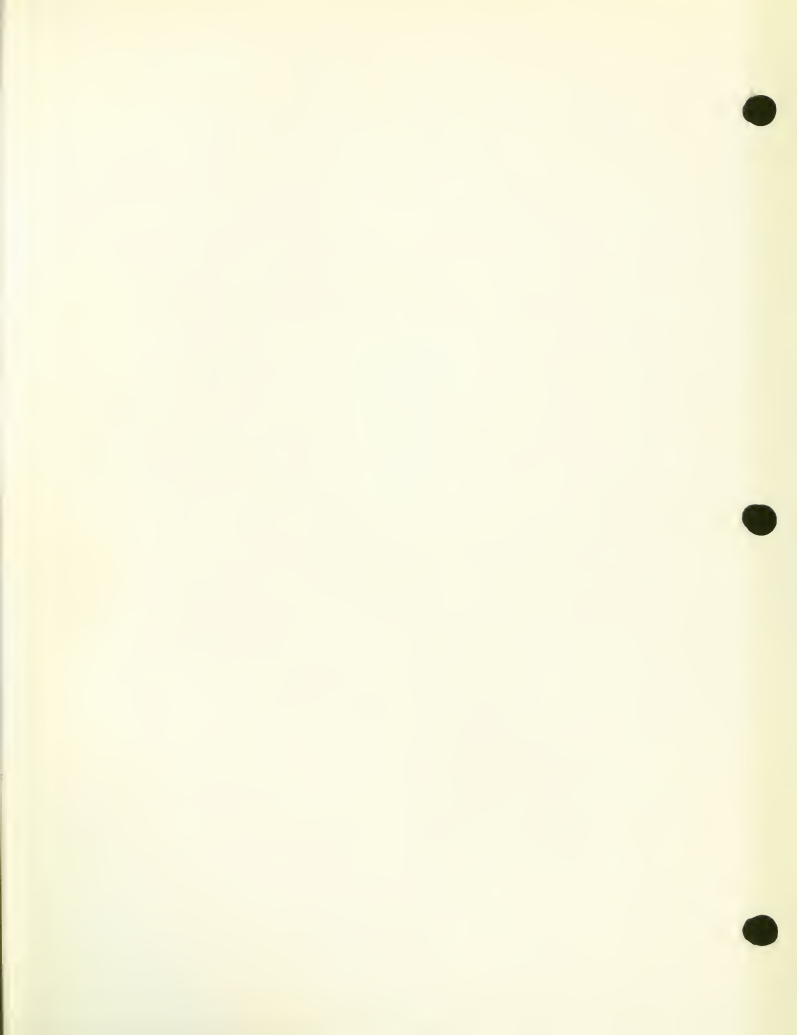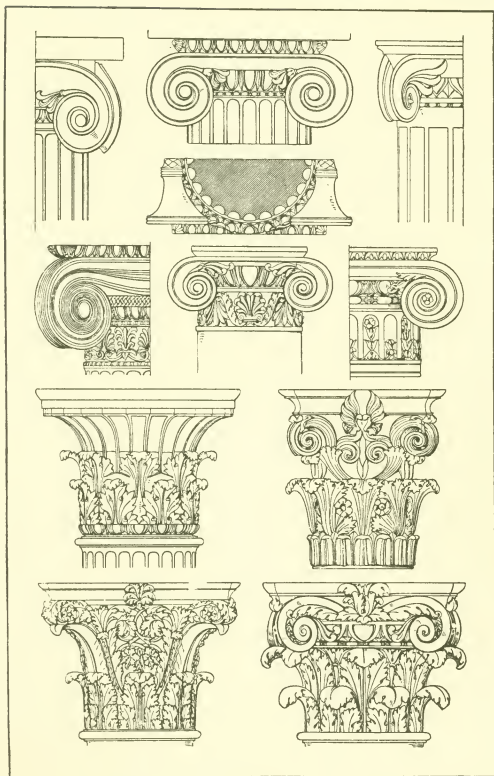
## The Indo-European family of languages

PROTO-INDO
EUROPEAN

INDO-IRANIAN
- Sanskrit
  - Romany
  - Urdu
  - Hindi
  - Bihari
  - Punjabi
- Iranian
  - Kurdish
  - Persian

ANATOLIAN
- Turkish
- Armenian

HELLENIC
- Greek
- Thracian
- Albanian

ITALIC
- Latin
  - Umbrian
  - Rumanian
  - Romance
  - Italian
  - French
  - Catalan
  - Spanish
  - Portuguese

CELTIC
- Breton
- Cornish
- Welsh
- Manx
- Scottish Gaelic
- Irish Gaelic

GERMANIC
- East Germanic
  - Gothic
- West Germanic
  - Yiddish
  - German
  - Afrikaans
  - Dutch
  - Frisian
  - Anglo-Saxon
    - English
- North Germanic
  - Danish
  - Swedish
  - Norwegian
  - Icelandic

BALTO-SLAVIC
- Slavic
  - East Slavic
    - Russian
    - Ukranian
  - South Slavic
    - Bulgarian
    - Macedonian
    - Serbo-Croatian
  - West Slavic
    - Czech
    - Slovak
    - Polish
- Baltic
  - Latvian
  - Lithuanian

©DIAGRAM

## Alphabets: Greek

| alpha (a) | beta (b) | gamma (g) | delta (d) |
|---|---|---|---|
| Α α | Β β | Γ γ | Δ δ |
| epsilon (e) | zeta (z) | eta (e) | theta (th) |
| Ε ε | Ζ ζ | Η η | θ ϑ |
| iota (i) | kappa (k) | lambda (l) | mu (m) |
| Ι ι | Κ κ | Λ λ | Μ μ |
| nu (n) | xi (x) | omicron (o) | pi (p) |
| Ν ν | Ξ ξ | Ο ο | Π π |
| rho (r) | sigma (s) | tau (t) | upsilon (u) |
| Ρ ρ | Σ σ ς | Τ τ | Υ υ |
| phi (ph) | khi (kh) | psi (ps) | omega (o) |
| Φ φ | Χ χ | Ψ ψ | Ω ω |

| Name | sound |
|---|---|
| **alpha** | **(a)** |

## Alphabets: Hebrew

| | | | |
|---|---|---|---|
| v | l | ts | |
| h | ch | f | t |
| d | k | p | t |
| g | y | ' | s |
| v | t | s | sh |
| b | ch | n | r |
| ' | z | m | k |

## Alphabets: Russian

| a | b | v | g | d |
|---|---|---|---|---|
| Аа | Бб | Вв | Гг | Дд |

| ye / e | zh | z | i |
|---|---|---|---|
| Ее | Жж | Зз | Ии |

| k | l | m | n |
|---|---|---|---|
| Кк | Лл | Мм | Нн |

| o | p | r | s | t |
|---|---|---|---|---|
| Оо | Пп | Рр | Сс | Тт |

| u | f | kh | ts | ch |
|---|---|---|---|---|
| Уу | Фф | Хх | Цц | Чч |

| sh | shch | (hard sign) | y |
|---|---|---|---|
| Шш | Щщ | Ъъ | Ыы |

| (soft sign) | e | yu | ya |
|---|---|---|---|
| Ьь | Ээ | Юю | Яя |

Sound
a

©DIAGRAM

## Alphabets: Braille

## North American manual alphabet
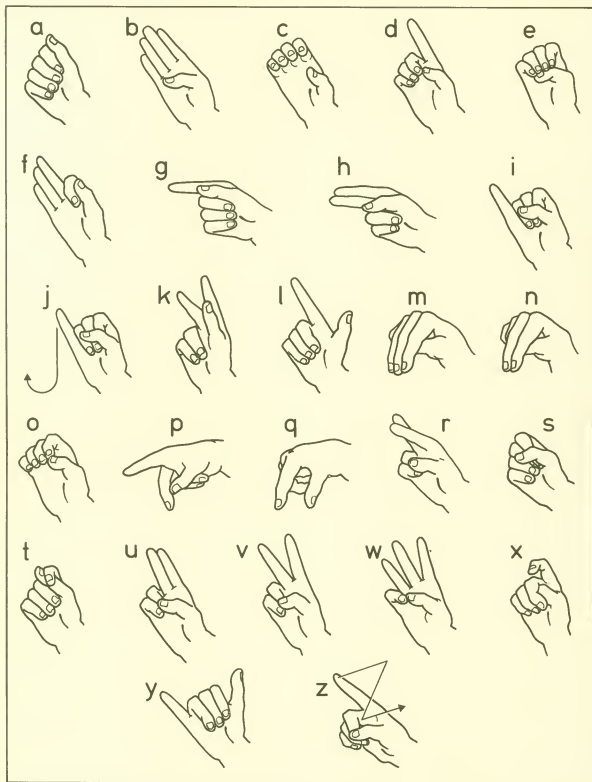
Capitals such as USA are indicated by making a clockwise
circle round each letter.

© DIAGRAM

## North American manual numbers
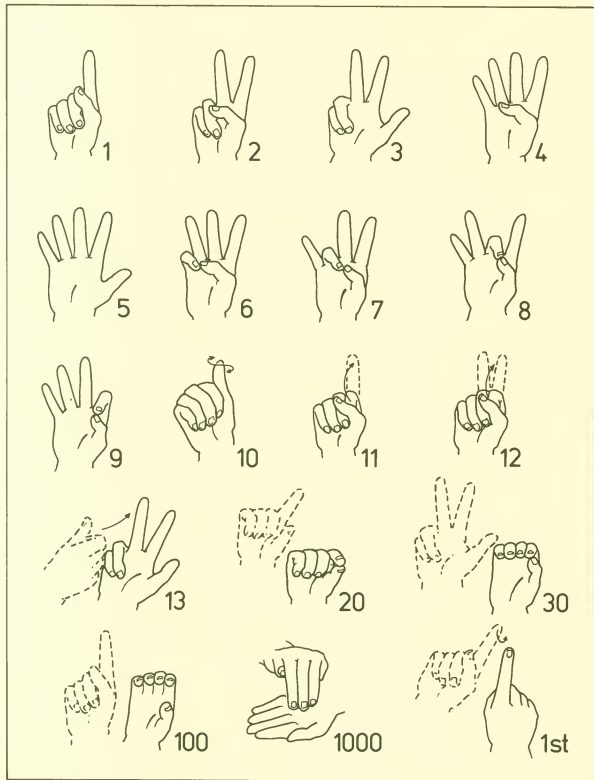
10 Shake thumb
11 Snap index finger up
12 Snap index and middle fingers up
13 Sign for 10 with palm facing in, then 3
20 Bring thumb and index fingers together
30 Sign for 3, then letter O
100 Sign for 1 and then letter C
1,000 Sign for M with right hand, tap left palm twice
1st, 2nd, 3rd, etc. Twist hand palm in using appropriate number.

## The international Morse code

| | | |
|---|---|---|
| A ●━ | J ●━━━ | S ●●● |
| B ━●●● | K ━●━ | T ━ |
| C ━●━● | L ●━●● | U ●●━ |
| D ━●● | M ━━ | V ●●●━ |
| E ● | N ━● | W ●━━ |
| F ●●━● | O ━━━ | X ━●●━ |
| G ━━● | P ●━━● | Y ━●━━ |
| H ●●●● | Q ━━●━ | Z ━━●● |
| I ●● | R ●━● | |

| | | |
|---|---|---|
| 1 ●━━━━ | 5 ●●●●● | 9 ━━━━● |
| 2 ●●━━━ | 6 ━●●●● | 0 ━━━━━ |
| 3 ●●●━━ | 7 ━━●●● | |
| 4 ●●●●━ | 8 ━━━●● | |

| | | |
|---|---|---|
| **Comma** ━━●●━━ | **Question mark** ●●━━●● | **Error** ●●●●●●●● |
| **Semicolon** ━●━●━● | **Quotation marks** ●━●●━● | **Understand** ●●●●━● |
| **Colon** ━━━●●● | **Wait** ●━●●● | **Hyphen** ━●●●●━ |
| **Period** ●━●━●━ | **End of message** ●━●━● | **Apostrophe** ●━━━━● |

Dot = short signal
Dash = long signal

## Semaphore

A & 1    B & 2    C & 3    D & 4    E & 5

F & 6    G & 7    H & 8    I & 9    J & Alphabetical

K & 0    L    M    N    O

P    Q    R    S    T

U    V    W    X    Y
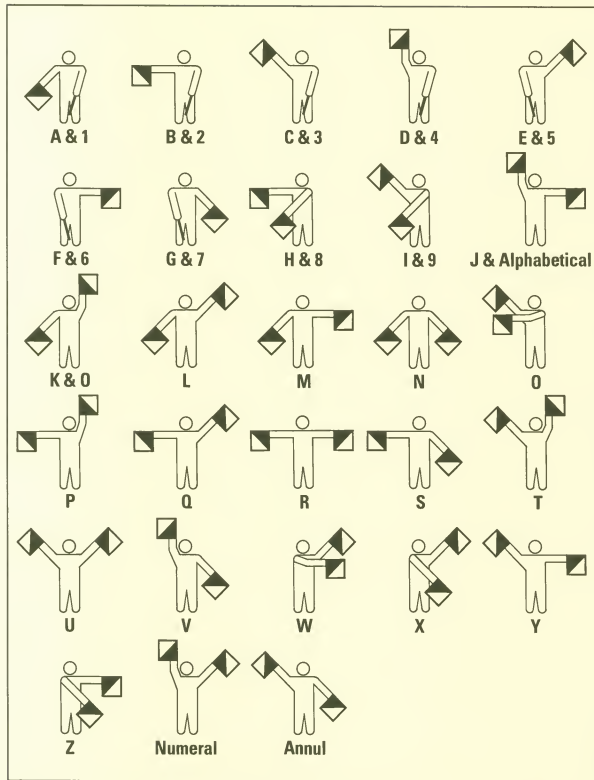
Z    Numeral    Annul

Semaphore is a visual signaling system using flags. At the end of each word drop the arms down in front of you and pause. If you make a mistake, give 'Annul' sign and start the word again. Use 'Numeral' before a number and 'Alphabetical' when you go back to letters.

©DIAGRAM

**Musical notation: 1**

THE DIATONIC SCALE

1 Staff
2 Treble (G) clef
3 Bass (F) clef
4 Alto (C) clef
5 Bar line
6 Measure
7 Final bar
8 Whole note (semibreve)
9 Half note (minim)
10 Quarter note (crotchet)
11 Eighth note (quaver)
12 Sixteenth note (semiquaver)
13 Whole rest
14 Half rest
15 Quarter rest
16 Eighth rest
17 Sixteenth rest
18 Measures rest
19 Triplet

©DIAGRAM

## Musical notation: 2

1 ¾ time
2 ⅞ time
3 ½ time
4 ⅜ time
5 ⅝ time
6 Triad (3 note chord)
7 Arpeggio (rolled chord)
8 Sharp
9 Flat
10 Natural
11 Double sharp
12 Double flat
13 Dissonance
14 Tie
15 Slur
16 Glissando
17 Legato
18 Non-legato
19 Repeat
20 Tremolo
21 Piano (soft)
22 Pianissimo (very soft)
23 Forte (loud)
24 Fortissimo (very loud)
25 Sforzando (with sudden force)
26 Crescendo
27 Decrescendo
28 Swell
29 Repeat from beginning
30 Turn
31 Trill
32 Staccato
33 Pause

**Musical notation: 3**

KEY SIGNATURES
1 G major
   E minor
2 D major
   B minor
3 A major
   F sharp minor
4 E major
   C sharp minor
5 B major
   G sharp minor
6 F sharp major
   D sharp minor
7 C sharp major
   A sharp minor
8 F major
   D minor
9 B flat major
   G minor
10 E flat major
   C minor
11 A flat major
   F minor
12 D flat major
   B flat minor
13 G flat major
   E flat minor
14 C flat major
   A flat minor

©DIAGRAM
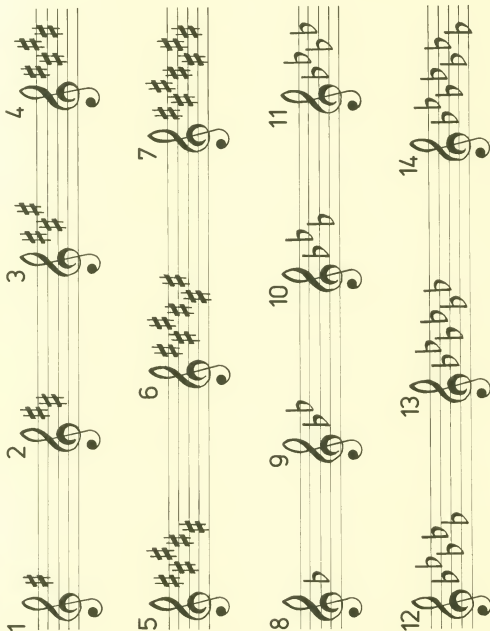
## Music: conductor's movements
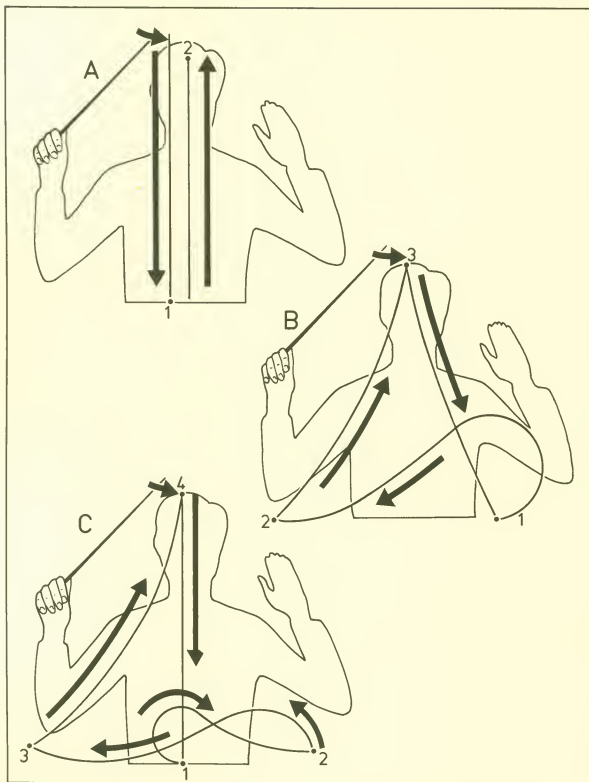
**A** 2/4 rhythm
**B** 3/4 rhythm
**C** 4/4 rhythm

The right hand (with baton) beats time.
The left hand indicates degree of loudness required.

©DIAGRAM

## Layout and instruments of an orchestra
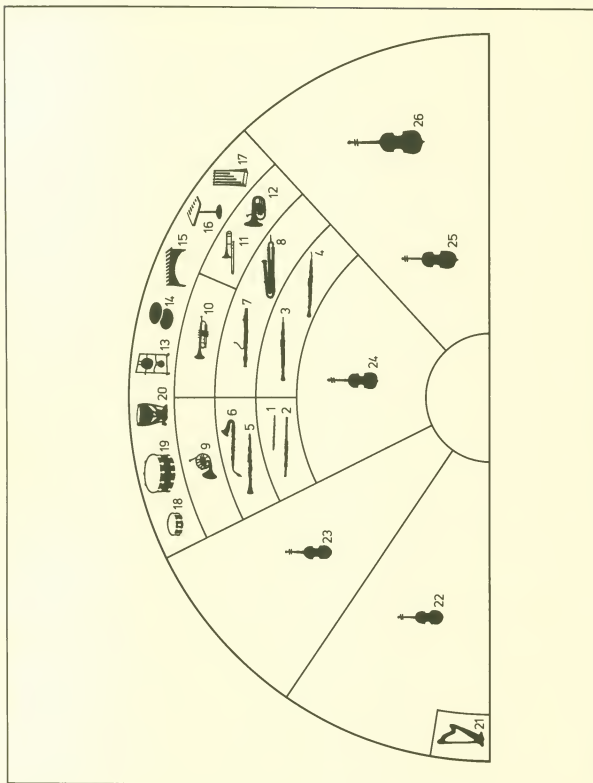
**Woodwind**
1 Piccolo
2 Flutes
3 Oboes
4 Cor anglais
5 Clarinets
6 Bass clarinet
7 Bassoons
8 Contrabassoons

**Brass**
9 Horns
10 Trumpets
11 Trombones
12 Tuba

**Percussion**
13 Tam-tam
14 Cymbals
15 Xylophone
16 Glockenspiel
17 Tubular bells
18 Side drum
19 Bass drum
20 Timpani

**Strings**
21 Harp
22 1st violins
23 2nd violins
24 Violas
25 Cellos
26 Double basses

©DIAGRAM

## Military marching band
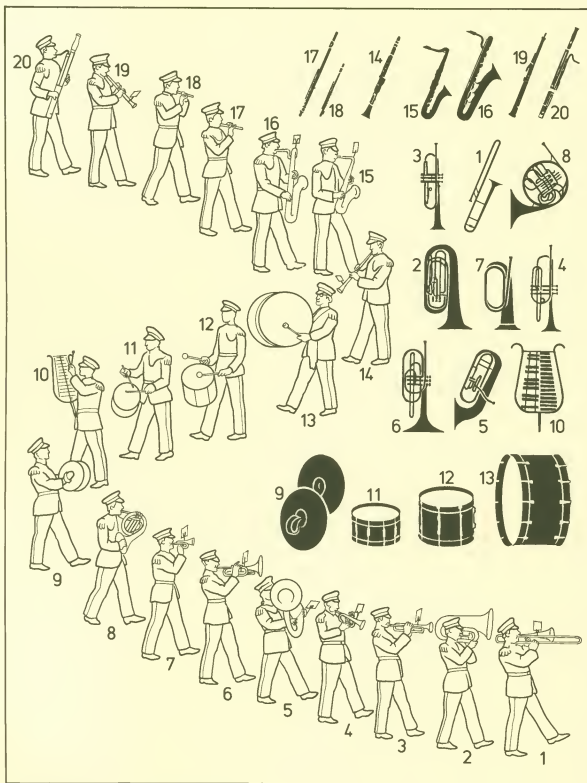
| | | | |
|---|---|---|---|
| 1 Trombone | | 11 Side drum | |
| 2 Marching tuba | | 12 Tenor drum | |
| 3 Trumpet | | 13 Bass drum | |
| 4 Cornet | | 14 Clarinet | |
| 5 Euphonium | | 15 Alto saxophone | |
| 6 Mellophone | | 16 Tenor saxophone | |
| 7 Bugle | | 17 Flute | |
| 8 Horn | | 18 Piccolo | |
| 9 Cymbals | | 19 Oboe | |
| 10 Glockenspiel | | 20 Bassoon | |

©DIAGRAM

## Jazz and rock bands
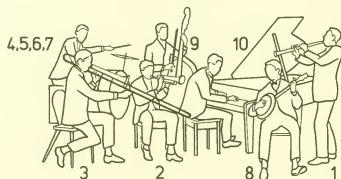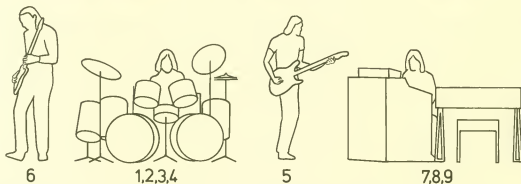
**A  Traditional jazz band**
1  Clarinet
2  Trumpet
3  Trombone
4  Cymbals
5  Bass drum
6  Side drum
7  Tenor drum
8  Banjo
9  Double bass
10 Piano

**B  Modern rock group**
1  Cymbals
2  Bass drum
3  Side drum
4  Tenor drum
5  Electric guitar
6  Electric bass guitar
7  Electric organ
8  Electric piano
9  Synthesizer

**Ballet**
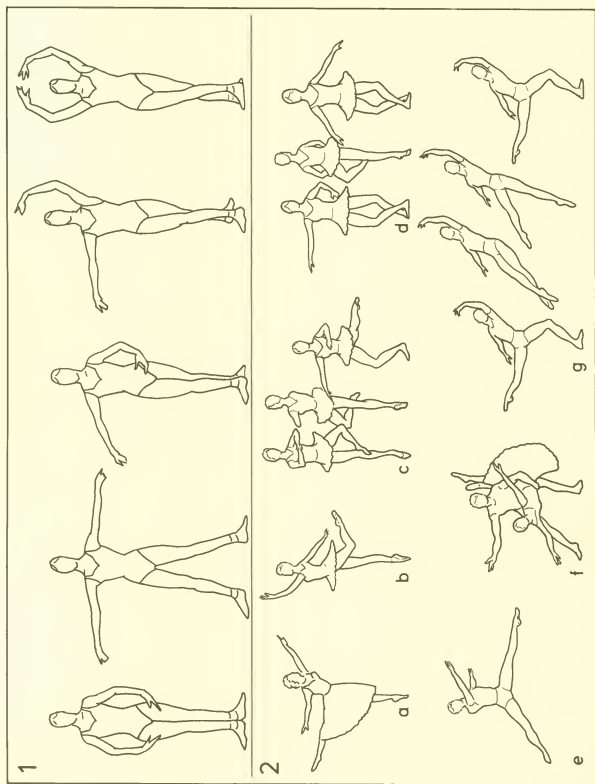
©DIAGRAM

1 Five basic positions
2 Ballet movements
a Arabesque
b Attitude
c Fouetté
d Pirouette
e Grand jeté
f Pas de deux
g Cabriole

## Clothes fashions: women

© DIAGRAM

| | |
|---|---|
| **1** Ancient Egyptian | **11** Puritan c 1650 |
| **2** Ancient Greek | **12** French c 1780 |
| **3** Ancient Roman | **13** French c 1805 |
| **4** French c 1250 | **14** English c 1817 |
| **5** Italian c 1300 | **15** American c 1850 |
| **6** French c 1430 | **16** American c 1870 |
| **7** English c 1540 | **17** French c 1906 |
| **8** Spanish c 1550 | **18** French c 1927 |
| **9** German c 1550 | **19** French c 1950 |
| **10** English c 1600 | **20** Modern blue jeans |

## Clothes fashions: men

©DIAGRAM

1 Ancient Egyptian
2 Ancient Greek
3 Ancient Roman
4 1st century Frankish
5 French c 1260
6 English c 1350
7 German c 1350
8 Italian c 1450
9 Italian c 1550
10 French c 1550

11 French knight c 1630
12 French c 1680
13 English c 1680
14 French c 1780
15 French c 1795
16 English c 1795
17 French c 1830
18 English c 1870
19 English Hunting 1950s
20 Modern business suit

## Fundamental vase forms
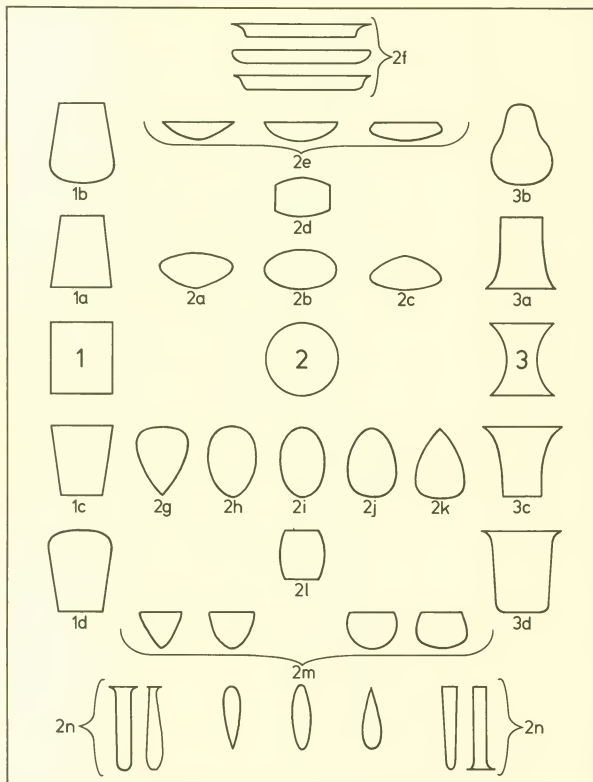
©DIAGRAM

| | | |
|---|---|---|
| **1** Cylindrical | **2d** Recumbent | **2m** Cup-shaped |
| **1a** Conical | **2e** Dish-shaped | **2n** Wedge, spindle and drop-shaped |
| **1b** Bag-shaped | **2f** Plate-shaped | **3** Hyperboloid |
| **1c** Inverted cone | **2g** Top-shaped | **3a** Hyperboloid foot |
| **1d** Canopus | **2h** Inverted egg | **3b** Pear-shaped |
| **2** Spherical | **2i** Ellipsoid | **3c** Hyperboloid neck |
| **2a** Echinus | **2j** Egg-shaped | **3d** Bell-shaped |
| **2b** Spheroid | **2k** Inverted top | |
| **2c** Cake-shaped | **2l** Erect cask | |

## Basic human proportions
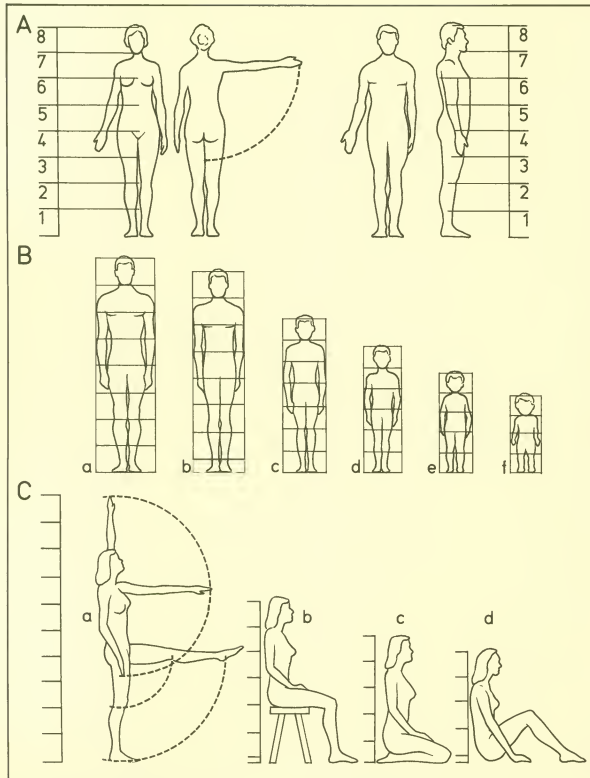
**A** Adult female and male divided into 8 units.
  1 unit = height of head (M 9"; F 8¼")
**a** Adult: head 9" × 8 units
**b** 15: head 9" × 7½ units
**c** 10: head 7½" × 7 units
**d** 5: head 7" × 6 units
**e** 3: head 6½" × 5 units
**f** 1: head 6" × 4 units

**C** Body positions by units
**a** Extended limbs = 10 units
**b** Seated = 6¼ units on chair
**c** Kneeling = 4¾ units
**d** Seated on floor = 4½ units

©DIAGRAM
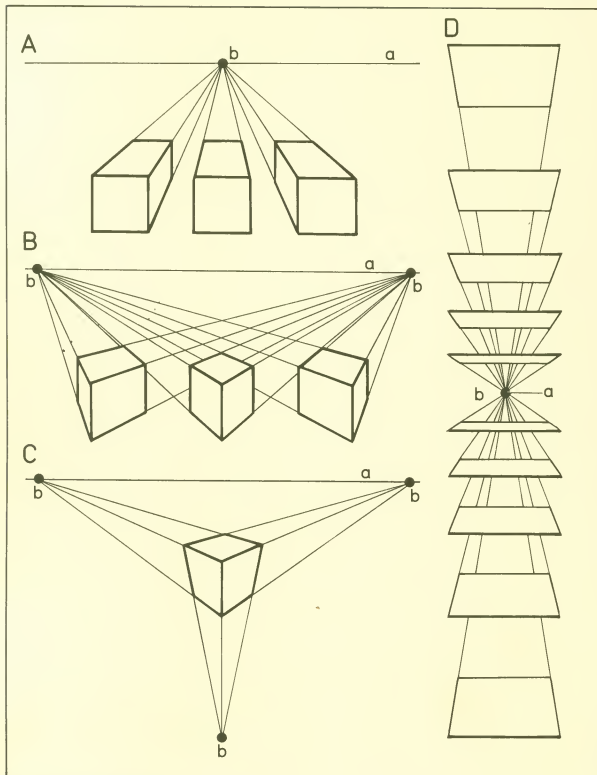
## Perspective

A Parallel perspective (one point)
B Angular perspective (two point)
C Oblique perspective (three point)
D Point of view

a Eye level
b Vanishing point

## Architecture: columns
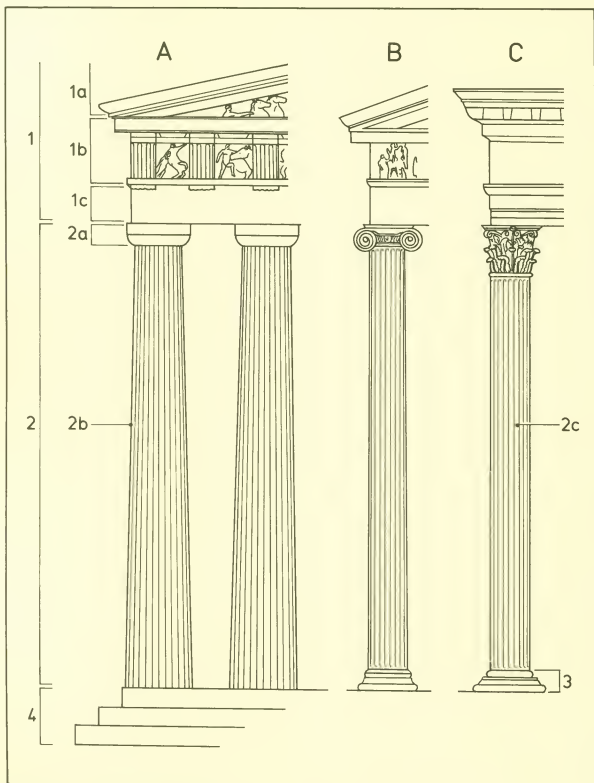
A Doric
B Ionic
C Corinthian
1 Entablature
1a Cornice
1b Frieze
1c Architrave
2 Column
2a Capital
2b Shaft

2c Fluting
3 Base
4 Pedestal

©DIAGRAM

## Development of lighting
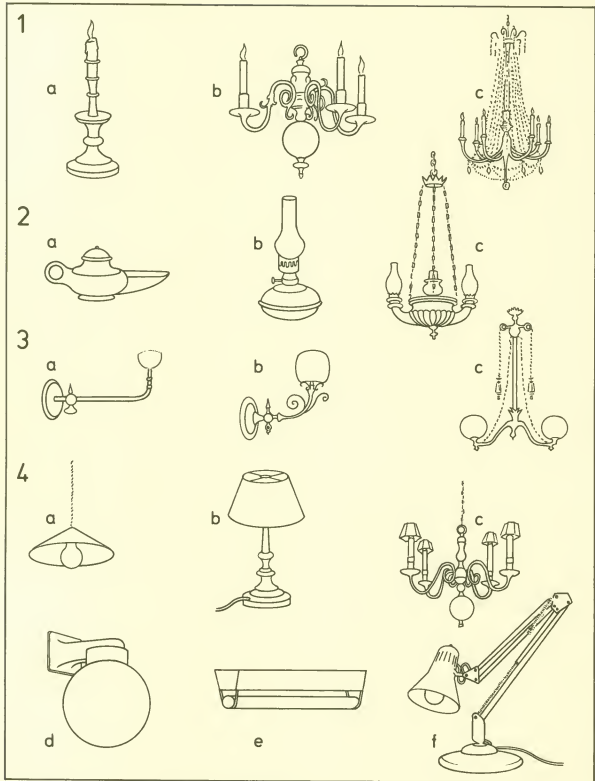
**1 Candles**
**1a** Single candlestick
**1b** Wall sconce
**1c** Ceiling candelabrum
**2 Oil lamps**
**2a** Roman lamp
**2b** Table lamp
**2c** Hanging lamp
**3 Gas**
**3a** Simple wall bracket
**3b** Elaborate wall bracket
**3c** Adjustable hanging lamp
**4 Electric**
**4a** Single bulb
**4b** Shaded table lamp
**4c** Imitation candle ceiling light
**4d** Globe shade
**4e** Neon
**4f** Desk anglepoise

©DIAGRAM

**Furniture styles: bed**
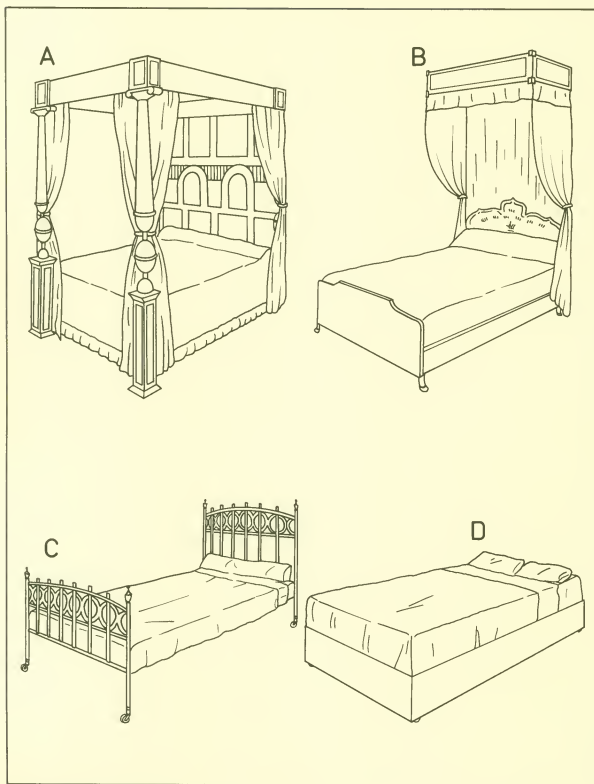
A  Four poster bed with curtain
B  Duchesse bed with part canopy and curtain
C  Brass bedstead
D  Modern bed

# Furniture styles: chair
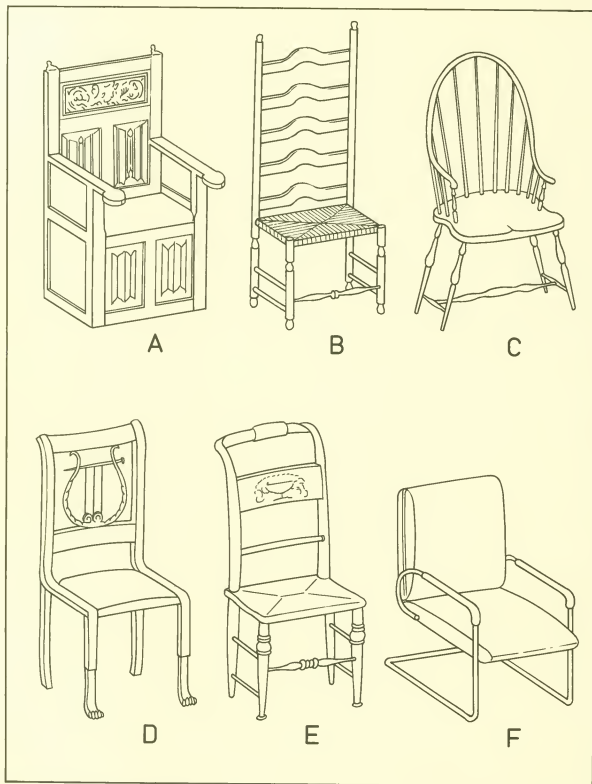
A  English 16th century framed oak
B  American early 18th century, Pennsylvania
C  New England Windsor, late 18th century
D  American, Duncan Phyfe, early 19th century
E  American Hitchcock chair, 19th century
F  Modern 20th century

© DIAGRAM

## US Presidents: 1 1789–1839

**1790** First US Census

1790

| PRESIDENT | VICE PRESIDENT |
|---|---|
| **George Washington**<br>— Apr 1789–Mar 1793<br>Mar 1793–Mar 1797 | John Adams |
| **John Adams**<br>Mar 1797–Mar 1801 | Thomas Jefferson |
| **Thomas Jefferson**<br>— Mar 1801–Mar 1805<br>Mar 1805–Mar 1809 | Aaron Burr<br>George Clinton |
| **James Madison**<br>— Mar 1809–Mar 1813<br>Mar 1813–Mar 1817 | George Clinton<br>Elbridge Gerry |
| **James Monroe**<br>— Mar 1817–Mar 1821<br>Mar 1821–Mar 1825 | Daniel D. Tompkins |
| **John Quincy Adams**<br>Mar 1825–Mar 1829 | John C. Calhoun |
| **Andrew Jackson**<br>— Mar 1829–Mar 1833<br>Mar 1833–Mar 1837 | John C. Calhoun<br>Martin Van Buren |
| **Martin Van Buren**<br>Mar 1837–Mar 1841 | Richard M. Johnson |

1800

**1803** Louisiana Purchase by USA from France

1810

1820

**1818–22** Creation of independent Latin American states

1830

**1830** First passenger railroad opened

1840

⊠ Federalist

▦ Democratic-Republican

▢ Democratic

©DIAGRAM

## US Presidents: 2 1839–1889

| | PRESIDENT | VICE PRESIDENT |
|---|---|---|
| 1840 | **William Henry Harrison**<br>Mar 1841–Apr 1841 | John Tyler |
| | **John Tyler**<br>Apr 1841–Mar 1845 | |
| | **James K. Polk**<br>Mar 1845–Mar 1849 | George M. Dallas |
| | **Zachary Taylor**<br>Mar 1849–July 1850 | Millard Fillmore |
| 1850 | **Millard Fillmore**<br>Jul 1850–Mar 1853 | |
| | **Franklin Pierce**<br>Mar 1853–Mar 1857 | William R. King |
| | **James Buchanan**<br>Mar 1857–Mar 1861 | John C. Breckinridge |
| 1860 | **Abraham Lincoln**<br>Mar 1861–Mar 1865<br>Mar 1865–Apr 1865 | Hannibal Hamlin<br>Andrew Johnson |
| | **Andrew Johnson**<br>Apr 1865–Mar 1869 | |
| 1870 | **Ulysses S. Grant**<br>Mar 1869–Mar 1873<br>Mar 1873–Mar 1877 | Schuyler Colfax<br>Henry Wilson |
| | **Rutherford B. Hayes**<br>Mar 1877–Mar 1881 | William A. Wheeler |
| 1880 | **James A. Garfield**<br>Mar 1881–Sep 1881 | Chester A. Arthur |
| | **Chester A. Arthur**<br>Sep 1881–Mar 1885 | |
| | **Grover Cleveland**<br>Mar 1885–Mar 1889 | Thomas A. Hendricks |
| 1890 | | |

**1861–5** American Civil War

**1881** Canadian Pacific Railway Co. formed

©DIAGRAM

Democratic

Whig

Republican

## US Presidents: 3 1889–1939

| PRESIDENT | VICE PRESIDENT |
|---|---|

**Benjamin Harrison**
Mar 1889–Mar 1893

Levi P. Morton

1890

**Grover Cleveland**
Mar 1893–Mar 1897

Adlai E. Stevenson

**William McKinley**
Mar 1897–Mar 1901
Mar 1901–Sep 1901

Garret A. Hobart
Theodore Roosevelt

1900

**Theodore Roosevelt**
Sep 1901–Mar 1905
Mar 1905–Mar 1909

Charles W. Fairbanks

**1906** San Francisco
earthquake

1910

**William H. Taft**
Mar 1909–Mar 1913

James S. Sherman

**1914–18** World
War I

**Woodrow Wilson**
Mar 1913–Mar 1917
Mar 1917–Mar 1921

Thomas R. Marshall

**1920** League of
Nations formed

**Warren G. Harding**
Mar 1921–Aug 1923

Calvin Coolidge

**Calvin Coolidge**
Aug 1923–Mar 1925
Mar 1925–Mar 1929

Charles G. Dawes

**1929** Wall Street Crash

1930

**Herbert C. Hoover**
Mar 1929–Mar 1933

Charles Curtis

**Franklin D. Roosevelt**
Mar 1933–Jan 1937
Jan 1937–Jan 1941
Jan 1941–Jan 1945
Jan 1945–Apr 1945

John N. Garner

Henry A. Wallace
Harry S. Truman

**1939–45** World
War II

1940

▓ Democratic

▤ Republican

©DIAGRAM

## US Presidents: 4 1939–1989

| | PRESIDENT | VICE PRESIDENT |
|---|---|---|
| 1940 | **Franklin D. Roosevelt** | |
| | Mar 1933–Jan 1937 | John N. Garner |
| | Jan 1937–Jan 1941 | |
| | Jan 1941–Jan 1945 | Henry A. Wallace |
| | Jan 1945–Apr 1945 | Harry S. Truman |
| **1945** Formation of United Nations | | |
| | **Harry S. Truman** | |
| | Apr 1945–Jan 1949 | |
| 1950 | Jan 1949–Jan 1953 | Alben W. Barkley |
| | **Dwight D. Eisenhower** | |
| | Jan 1953–Jan 1957 | Richard M. Nixon |
| | Jan 1957–Jan 1961 | |
| 1960 | **John F. Kennedy** | |
| **1961–73** Vietnam War | Jan 1961–Nov 1963 | Lyndon B. Johnson |
| | **Lyndon B. Johnson** | |
| | Nov 1963–Jan 1965 | |
| | Jan 1965–Jan 1969 | Hubert H. Humphrey |
| 1970 | **Richard M. Nixon** | |
| | Jan 1969–Jan 1973 | Spiro T. Agnew |
| | Jan 1973–Aug 1974 | Gerald R. Ford |
| | **Gerald R. Ford** | |
| | Aug 1974–Jan 1977 | Nelson A. Rockefeller |
| | **Jimmy (James E.) Carter** | |
| | Jan 1977–Jan 1981 | Walter F. Mondale |
| 1980 | | |
| | **Ronald Reagan** | |
| | Jan 1981–Jan 1985 | George Bush |
| | Jan 1985– | |
| 1990 | | |

Democratic

Republican

©DIAGRAM

## Kings and Queens of England and Great Britain

1000

William I (1066–87)

William II (1087–1100)

1100

Henry I (1100–35)

Stephen (1135–54)

Henry II (1154–89)

Richard I (1189–99)

1200

John (1199–1216)

Henry III (1216–72)

Edward I (1272–1307)

1300

Edward II (1307–27)

Edward III (1327–77)

Richard II (1377–99)

1400

Henry IV (1399–1413)

Henry V (1413–22)

Henry VI (1422–61)

Edward IV (1461–70)
Henry VI (1470–71)
Edward IV (1471–83)
Edward V (1483–83)
Richard III (1483–85)

Henry VII (1485–1509)

1500

Henry VIII (1509–47)

Edward VI (1547–53)
Mary I (1553–58)

Elizabeth I (1558–1603)

1600

James I (1603–25)

Charles I (1625–49)

Charles II (1660–85)

James II (1685–88)
William III (1689–1702) and Mary II (1689–94)

1700

Anne (1702–14)

George I (1714–27)

George II (1727–60)

George III (1760–1820)

1800

George IV (1820–30)
William IV (1830–37)

Victoria (1837–1901)

1900

Edward VII (1901–10)

George V (1910–36)

Edward VIII (1936–36)
George VI (1936–52)

Elizabeth II (1952–      )

1 1492 Christopher Columbus landed in West Indies
2 1620 Mayflower landed with Pilgrims
3 1776 Declaration of Independence
4 1861–65 Civil War
5 1914–18 World War I
6 1939–45 World War II

©DIAGRAM

## Popes of the 19th and 20th centuries

05.032



**1800** — Napoleonic Wars

Pius VII

**1820**

Leo XII

**1830** Pius VIII

Gregory XVI

**1840**

**1850** Crimean War

US Civil War

**1860** Pius IX

**1870**

**1880**

Leo XIII

**1890**

**1900**

**1900**

**1910** Pius X

World War I — Benedict XV

**1930** Pius XI

World War II

**1950** Pius XII

**1960** John XXIII

Vietnam

Paul VI

John Paul I

**1980**

John Paul II

**1990**

**2000**

©DIAGRAM

| | |
|---|---|
| **Pius VII** | Luigi Barnaba Chiaramonti (1740–1823) |
| **Leo XII** | Annibale Sermattei della Genga (1760–1829) |
| **Pius VIII** | Francesco Xaviero Castiglioni (1761–1830) |
| **Gregory XVI** | Bartolommeo Alberto Cappellari (1765–1846) |
| **Pius IX** | Giovanni Maria Masttai-Ferretti (1792–1878) |
| **Leo XIII** | Vincenzo Gioacchino Pecci (1810–1903) |
| **Pius X** | Giuseppe Melchiorre Sarto (1835–1914) |

| | |
|---|---|
| **Benedict XV** | Giacomo della Chiesa (1854–1922) |
| **Pius XI** | Achille Ratti (1857–1939) |
| **Pius XII** | Eugenio Pacelli (1876–1958) |
| **John XXIII** | Angelo Giuseppe Roncalli (1881–1963) |
| **Paul VI** | Giovanni Battista Montini (1897–1978) |
| **John Paul I** | Albino Luciani (1913–1978) |
| **John Paul II** | Karol Wojtyla (1920–    ) |

## William Shakespeare: first performances of plays

| | | |
|---|---|---|
| 1560 | 1580 | 1600 |
| | | Hamlet |
| | | The Merry Wives of Windsor |
| | | Twelfth Night |
| | | Troilus and Cressida |
| | Marriage to Anne Hathaway 1582 | All's Well That Ends Well |
| | Birth of daughter Susanna | |
| Baptism April 26 1564 | | Measure For Measure |
| | | Othello |
| 1565 | Birth of twins Judith and Hamnet | 1605 |
| | | King Lear |
| | | Macbeth |
| | | Antony and Cleopatra |
| | | Coriolanus |
| | | Timon of Athens |
| | | Pericles |
| | | Cymbeline |
| 1570 | 1590 | 1610 |
| | Henry VI (Part 1) | Winter's Tale |
| | Henry VI (Part 2) | |
| | Henry VI (Part 3) | The Tempest |
| | | Henry VIII |
| | Richard III | The Two Noble Kinsmen |
| | The Comedy of Errors | |
| | Titus Andronicus | |
| | The Taming of the Shrew | |
| | The Two Gentlemen of Verona | |
| | Love's Labour's Lost | |
| | Romeo and Juliet | |
| 1575 | 1595 | 1615 |
| | Richard II | |
| | A Midsummer Night's Dream | Death April 23 1616 aged 52 |
| | King John | |
| | The Merchant of Venice | |
| | Henry IV (Part 1) | |
| | Henry IV (Part 2) | |
| | Much Ado About Nothing | |
| | Henry V | |
| | Julius Caesar | |
| | As You Like It | |
| 1580 | 1600 | 1620 |

1 1558 Elizabeth I became Queen of England
2 1584 Sir Walter Raleigh founded Virginia
3 1588 Armada (naval conflict between England and Spain)
4 1603 Death of Queen Elizabeth I
5 1620 Pilgrims on Mayflower sailed from England

©DIAGRAM

## US States: dates of entry into Union

| State | Year | Date |
|---|---|---|
| Delaware | 1787 | Dec 7 |
| Pennsylvania | 1787 | Dec 12 |
| New Jersey | 1787 | Dec 18 |
| Georgia | 1788 | Jan 2 |
| Connecticut | 1788 | Jan 9 |
| Massachusetts | 1788 | Feb 6 |
| Maryland | 1788 | Apr 28 |
| South Carolina | 1788 | May 23 |
| New Hampshire | 1788 | Jun 21 |
| Virginia | 1788 | Jun 26 |
| New York | 1788 | Jul 26 |
| North Carolina | 1789 | Nov 21 |
| Rhode Island | 1790 | May 29 |
| Vermont | 1791 | Mar 4 |
| Kentucky | 1792 | Jun 1 |
| Tennessee | 1796 | Jun 1 |
| Ohio | 1803 | Mar 1 |
| Louisiana | 1812 | Apr 30 |
| Indiana | 1816 | Dec 11 |
| Mississippi | 1817 | Dec 10 |
| Illinois | 1818 | Dec 3 |
| Alabama | 1819 | Dec 14 |
| Maine | 1820 | Mar 15 |
| Missouri | 1821 | Aug 10 |
| Arkansas | 1836 | Jun 15 |
| Michigan | 1837 | Jan 26 |
| Florida | 1845 | Mar 3 |
| Texas | 1845 | Dec 29 |
| Iowa | 1846 | Dec 28 |
| Wisconsin | 1848 | May 29 |
| California | 1850 | Sep 9 |
| Minnesota | 1858 | May 11 |
| Oregon | 1859 | Feb 14 |
| Kansas | 1861 | Jan 29 |
| West Virginia | 1863 | Jun 20 |
| Nevada | 1864 | Oct 31 |
| Nebraska | 1867 | Mar 1 |
| Colorado | 1876 | Aug 1 |
| North Dakota | 1889 | Nov 2 |
| South Dakota | 1889 | Nov 2 |
| Montana | 1889 | Nov 8 |
| Washington | 1889 | Nov 11 |
| Idaho | 1890 | Jul 3 |
| Wyoming | 1890 | Jul 10 |
| Utah | 1896 | Jan 4 |
| Oklahoma | 1907 | Nov 16 |
| New Mexico | 1912 | Jan 6 |
| Arizona | 1912 | Feb 14 |
| Alaska | 1959 | Jan 3 |
| Hawaii | 1959 | Aug 21 |

(16) (45) (31) (50)

©DIAGRAM

Number in circle denotes the number of states in the Union at that date

## Seals of 50 states of the Union: 1

Alabama

Alaska

Arizona

Arkansas

California

Colorado

Connecticut

Delaware

Florida

Georgia

## Seals of 50 states of the Union: 2

Hawaii

Idaho

Illinois

Indiana

Iowa

Kansas

Kentucky

Louisiana

Maine

Maryland

## Seals of 50 states of the Union: 3

Massachusetts

Michigan

Minnesota

Mississippi

Missouri

Montana

Nebraska

Nevada

New Hampshire

New Jersey

©DIAGRAM
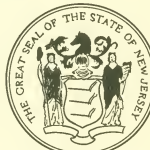
## Seals of 50 states of the Union: 4
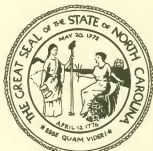
New Mexico

New York

North Carolina

North Dakota

Ohio

Oklahoma

Oregon

Pennsylvania

Rhode Island

South Carolina

## Seals of 50 states of the Union: 5

South Dakota

Tennessee

Texas

Utah

Vermont

Virginia

Washington

West Virginia

Wisconsin

Wyoming

## US Government: the Constitution

**THE CONSTITUTION**

**LEGISLATIVE BRANCH**

**THE CONGRESS**

Senate          House

Architect of the Capitol
United States Botanic
Garden
General Accounting Office
Government Printing Office
Library of Congress
Office of Technology
Assessment
Congressional Budget
Office
Copyright Royalty Tribunal

**EXECUTIVE BRANCH**

**THE PRESIDENT**

**Executive Office of the President**

White House Office
Office of Management and
Budget
Council of Economic
Advisers
National Security Council
Office of Policy
Development
Office of the United States
Trade Representative
Council on Environmental
Quality
Office of Science and
Technology Policy
Office of Administration

THE VICE PRESIDENT

**JUDICIAL BRANCH**

**The Supreme Court of the United States**

United States Courts of
Appeals
United States District
Courts
United States Claims Court
United States Court of
Appeals for the Federal
Circuit
United States Court of
International Trade
Territorial Courts
United States Court of
Military Appeals
United States Tax Court
Administrative Office of the
United States Courts
Federal Judicial Center

©DIAGRAM

## US Government: the Senate

THE VICE PRESIDENT

MINORITY LEADER

MINORITY SECRETARY

PRESIDENT PRO TEMPORE

MAJORITY LEADER

MAJORITY SECRETARY

ASSISTANT MINORITY LEADER

LEGISLATIVE COUNSEL

ASSISTANT MAJORITY LEADER

LEGAL COUNSEL

SERGEANT AT ARMS

SECRETARY OF THE SENATE

CHAPLAIN

ASSISTANT SECRETARY OF THE SENATE

CAPITOL GUIDE BOARD

MEDIA GALLERIES

EXECUTIVE OFFICE

CAPITOL POLICE BOARD

**ADMINISTRATIVE**
Administrative Services
Office Services
Interparliamentary Services
Special Deputy to the Federal Election Commission

Disbursing Office

Library

SENATE COMPUTER CENTER

FACILITIES AND FINANCIAL MANAGEMENT
Accounting
Cabinet Shop
Custodial Service
Hair Care
Housekeeping
Parking
Senate garage

HUMAN RESOURCES
Placement and Special Services

Document Room

**LEGISLATIVE**
Parliamentarian
Journal Clerk
Legislative Clerk
Executive Clerk
Printing Services
Bill Clerk
Official Reporters of Debates
Senate Daily Digest

Stationery Room

Curator of Art and Antiquities

PHOTOGRAPHIC AND RECORDING STUDIOS

SERVICE DEPARTMENT

Senate Historian

SENATE POST OFFICE

TELE-COMMUNICATIONS

Office of Public Records

CAPITOL GUIDES

CAPITOL POLICE

Office of Classified National Security Information

—— Direct responsibility
---- Oversight responsibility

©DIAGRAM

## US Government: the House of Representatives

HOUSE OF REPRESENTATIVES

MINORITY LEADER

MINORITY WHIP

LAW REVISION COUNSEL

PARLIAMENTARIAN

SERGEANT AT ARMS

THE SPEAKER

CLERK

CHAPLAIN

DOORKEEPER

COMMITTEE ON RULES

POSTMASTER

LEGISLATIVE COUNSEL

MAJORITY LEADER

MAJORITY WHIP

HOUSE OFFICE BUILDINGS COMMISSION

©DIAGRAM

## US Government: the organization of the Presidency

THE PRESIDENT

OFFICE OF THE
VICE PRESIDENT

THE WHITE HOUSE
OFFICE

EXECUTIVE OFFICE

EXECUTIVE RESIDENCE

OFFICE OF POLICY
DEVELOPMENT

NATIONAL SECURITY
COUNCIL

OFFICE OF
SCIENCE AND
TECHNOLOGY POLICY

COUNCIL OF
ECONOMIC ADVISERS

OFFICE OF
MANAGEMENT AND
BUDGET

OFFICE OF
ADMINISTRATION

COUNCIL ON
ENVIRONMENTAL
QUALITY

OFFICE OF THE
UNITED STATES TRADE
REPRESENTATIVE

THE CABINET

© DIAGRAM

## US Government: the Department of State

SECRETARY

ARMS CONTROL AND
DISARMAMENT AGENCY

UNITED STATES
INFORMATION AGENCY

DEPUTY SECRETARY

INTERNATIONAL
DEVELOPMENT
COOPERATION
AGENCY

AGENCY FOR
INTERNATIONAL
DEVELOPMENT

UNDER SECRETARY
FOR POLITICAL
AFFAIRS

UNDER SECRETARY
FOR ECONOMIC
AND AGRICULTURAL
AFFAIRS

UNDER SECRETARY
FOR MANAGEMENT

COUNSELOR

UNDER SECRETARY
FOR SECURITY
ASSISTANCE,
SCIENCE AND
TECHNOLOGY

INSPECTOR
GENERAL

EXECUTIVE
SECRETARY

MANAGEMENT
OPERATIONS

DIRECTOR GENERAL,
FOREIGN SERVICE
AND DIRECTOR OF
PERSONNEL

COUNTER
TERRORISM

POLICY AND
PROGRAM REVIEW

PROTOCOL

COMPTROLLER

FOREIGN
SERVICE
INSTITUTE

LEGISLATIVE AND
INTERGOVERNMENTAL
AFFAIRS

POLICY
PLANNING
COUNCIL

ADMINISTRATION

DIPLOMATIC
SECURITY

PUBLIC
AFFAIRS

HUMAN RIGHTS
AND HUMANITARIAN
AFFAIRS

EQUAL OPPORTUNITY
AND CIVIL RIGHTS

MEDICAL
SERVICES

OFFICE OF
FOREIGN MISSIONS

LEGAL
ADVISER

CONSULAR
AFFAIRS

REFUGEE
PROGRAMS

INTELLIGENCE
AND RESEARCH

POLITICO-
MILITARY
AFFAIRS

ECONOMIC
AND BUSINESS
AFFAIRS

INTERNATIONAL
NARCOTICS
MATTERS

OCEANS AND
INTERNATIONAL
ENVIRONMENTAL
AND SCIENTIFIC
AFFAIRS

INTERNATIONAL
COMMUNICATIONS
AND INFORMATION
POLICY

EUROPEAN AND
CANADIAN AFFAIRS

AFRICAN
AFFAIRS

EAST ASIAN AND
PACIFIC AFFAIRS

INTER-AMERICAN
AFFAIRS

NEAR EASTERN
AND SOUTH ASIAN
AFFAIRS

INTERNATIONAL
ORGANIZATION
AFFAIRS

DIPLOMATIC, CONSULAR, AND OTHER ESTABLISHMENTS
AND DELEGATIONS TO INTERNATIONAL ORGANIZATIONS

——— Direct responsibility
- - - Oversight responsibility

© DIAGRAM

## US Government: the Judiciary

**State Judicial System**

**State Supreme Court**
Also called Supreme Court, Supreme Judicial Court, Supreme Court of Appeals, Supreme Court of Errors, Court of Appeals. Court of final resort.

**Intermediate Appellate Courts**
Only 20 out of the 50 states have Intermediate Appellate Courts. It is an intermediate appellate tribunal between the court of final resort and the trial court. The majority of cases are settled finally by the appellate courts.

**Trial Courts of Original and General Jurisdiction**
Also called Court of Common Pleas, Circuit Court, District Court and, in New York, Supreme Court. Highest trial court with original and general jurisdiction.

**Courts of Limited Jurisdiction**
Also called Police, Small Claims, Justice of the Peace, Probate, Family, Municipal, Magistrates, Traffic, Juvenile Courts and other names. Lowest Courts in judicial hierarchy.

**Federal Judicial System**

State Supreme Courts

US Courts of Appeals (12 Circuits)

Specialized Courts
1. US Tax Court
2. US Court of Claims
3. US Court of Customs and Patent Appeals

Federal Agencies (ICC, SEC, NRLB, etc.)

Administrative Law Judges

US Supreme Court (Nine Justices)

Administrative Office of US Courts

US Three-Judge District Courts

US District Courts
1. 89 districts in 50 states
2. 4 in territories
3. 1 in Washington DC

Bankruptcy Judges

US Magistrates

©DIAGRAM

# US Government: how a bill becomes law

HOUSE OF REPRESENTATIVES     SENATE

Introduction    ①    Introduction

**Committee action**    House committee ②    ② Senate committee    **Committee action**

Subcommittee ②    ② Subcommittee

Full committee ②    ② Full committee

Rules committee ③

**Floor action**      **Floor action**

Debate Vote on passage ④    ④ Debate Vote on passage

**Conference action**    ⑤

Chamber ⑥    ⑥ Chamber

Veto ⑦    President    ⑦ **Signature (pass)**

**Stages**

**1** Bill introduced in either chamber.

**2** Bill then goes to full committee, then sub-committee for hearings, revisions and approval, then back to full committee for possibly more hearings and revisions. Full committee may recommend passage of bill, give unfavorable recommendation (rarely happens), or take no action, letting bill die.

**3** In House, before floor action, many bills go to Rules Committee, which sets conditions for debate and amendments on floor. Some bills go directly to the floor. Other procedures exist for routine bills. Rules are not used in the Senate: leadership schedules action.

**4** Bill is debated, generally amended, and a vote is taken. If passed, bill goes to other chamber and follows a similar route. If other chamber has already passed a similar version, both versions go to conference.

**5** Conference committee comprising members of both houses works out difference between House and Senate versions of bill.

**6** Compromise version worked out in stage 5 is sent to each house for final approval.

**7** If compromise version approved by both houses, bill is sent to President, who either signs the bill, making it law, or vetoes it, and returns it to Congress. Vetoed bills may be overridden by a two-thirds majority in both houses; such bills then become law.

## US government: marriage with parental consent

05.047

| State | AGE Male | AGE Female |
|---|---|---|
| Nebraska | 16 | 16 |
| Nevada | 16 | 16 |
| New Hampshire | 14 | 13 |
| New Jersey | 16 | 16 |
| New Mexico | 16 | 16 |
| New York | 16 | 14 |
| North Carolina | 16 | 16 |
| North Dakota | 16 | 16 |
| Ohio | 18 | 16 |
| Oklahoma | 16 | 16 |
| Oregon | 17 | 17 |
| Pennsylvania | 16 | 16 |
| Rhode Island | 18 | 15 |
| South Carolina | 16 | 16 |
| South Dakota | 16 | 15 |
| Tennessee | 16 | 15 |
| Texas | 14 | 14 |
| Utah | 14 | 14 |
| Vermont | 16 | 16 |
| Virginia | 16 | 16 |
| Washington | 17 | 17 |
| West Virginia | 18 | 16 |
| Wisconsin | 16 | 16 |
| Wyoming | 16 | 16 |
| District of Columbia | 16 | 16 |

| State | AGE Male | AGE Female |
|---|---|---|
| Alabama | 13 | 14 |
| Alaska | 16 | 16 |
| Arizona | 16 | 16 |
| Arkansas | 17 | 16 |
| California * | — | — |
| Colorado | 16 | 16 |
| Connecticut | 16 | 16 |
| Delaware | 18 | 16 |
| Florida | 16 | 16 |
| Georgia | 16 | 16 |
| Hawaii | 16 | 16 |
| Idaho | 16 | 16 |
| Illinois | 16 | 16 |
| Indiana | 17 | 17 |
| Iowa * | — | — |
| Kansas | 18 | 16 |
| Kentucky | 18 | 16 |
| Louisiana | 18 | 16 |
| Maine | 16 | 16 |
| Maryland | 18 | 18 |
| Massachusetts | 18 | 18 |
| Michigan | 16 | 16 |
| Minnesota | 16 | 16 |
| Mississippi | 17 | 15 |
| Missouri | 15 | 15 |
| Montana | 15 | 15 |

* No age limits

© DIAGRAM

## US government: marriage without parental consent

**Top chart**

| STATE | Female 15 | 16 | 17 | 18 | 21 | Male 15 | 16 | 17 | 18 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|
| Nebraska | | | | | | ● | | | | |
| Nevada | | | ● | | | | | ● | | |
| New Hampshire | | | | ● | | | | | ● | |
| New Jersey | | | | ● | | | | | ● | |
| New Mexico | | | | ● | | | | | ● | |
| New York | | | | ● | | | | | ● | |
| North Carolina | | | | ● | | | | | ● | |
| North Dakota | | | | ● | | | | | ● | |
| Ohio | | | | ● | | | | | ● | |
| Oklahoma | | | | ● | | | | | ● | |
| Oregon | | | | ● | | | | | ● | |
| Pennsylvania | | | | ● | | | | | ● | |
| Rhode Island | | | | | ● | | | | | ● |
| South Carolina | | | | ● | | | | | ● | |
| South Dakota | | | | ● | | | | | ● | |
| Tennessee | | | | ● | | | | | ● | |
| Texas | | | | ● | | | | | ● | |
| Utah | | | | ● | | | | | ● | |
| Vermont | | | | ● | | | | | ● | |
| Virginia | | | | ● | | | | | ● | |
| Washington | | | | ● | | | | | ● | |
| West Virginia | | | | ● | | | | | ● | |
| Wisconsin | | | | ● | | | | | ● | |
| Wyoming | | | | ● | | | | | ● | |
| District of Columbia | | | | ● | | | | | ● | |

**Bottom chart**

| STATE | Female 15 | 16 | 17 | 18 | 21 | Male 15 | 16 | 17 | 18 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|
| Alabama | | | | ● | | | | | ● | |
| Alaska | | | | ● | | | | | ● | |
| Arizona | | | | ● | | | | | ● | |
| Arkansas | | | | ● | | | | | ● | |
| California | | | | ● | | | | | ● | |
| Colorado | | | | ● | | | | | ● | |
| Connecticut | | | | ● | | | | | ● | |
| Delaware | | | | ● | | | | | ● | |
| Florida | | | | ● | | | | | ● | |
| Georgia | | ● | | | | ● | | | | |
| Hawaii | | | | ● | | | | | ● | |
| Idaho | | | | ● | | | | | ● | |
| Illinois | | | | ● | | | | | ● | |
| Indiana | | | | ● | | | | | ● | |
| Iowa | | | | ● | | | | | ● | |
| Kansas | | | | ● | | | | | ● | |
| Kentucky | | | | ● | | | | | ● | |
| Louisiana | | | | ● | | | | | ● | |
| Maine | | | | ● | | | | | ● | |
| Maryland | | | | ● | | | | | ● | |
| Massachusetts | | | | ● | | | | | ● | |
| Michigan | | | | ● | | | | | ● | |
| Minnesota | | | | ● | | | | | ● | |
| Mississippi | | | | | | | | ● | | |
| Missouri | ● | | | ● | | | | | ● | |
| Montana | | | | ● | | | | | ● | |

©DIAGRAM

## Countries of the World: 1

| COUNTRY | CAPITAL | PREDOMINANT LANGUAGES● | CURRENCY |
|---|---|---|---|
| **AFGHANISTAN** | Kabul | Pashta (Iranian), Dari Persian, Uzbek (Turkic) | Afghani |
| DE AFGHANISTAN DEMOCRATEEK JAMHURIAT | | | |
| **ALBANIA** | Tirana | Albanian, Greek | Lek |
| REPUBLIKA POPULLORE SOCIALISTE E SHQIPËRISË | | | |
| **ALGERIA** | Algiers | **Arabic,** Berber, French | Dinar |
| AL-JUMHURIYA AL-JAZĀIRIYA AD-DIMUQRATIYA ASH-SHABIYA | | | |
| **ANDORRA** | Andorra la Vella | **Catalan,** Spanish, French | French franc Spanish peseta |
| PRINCIPAT D'ANDORRA | | | |
| **ANGOLA** | Luanda | **Portuguese,** Bantu (various) | Kwanza |
| REPÚBLICA POPULAR DE ANGOLA | | | |
| **ANTIGUA AND BARBUDA** | St John's | **English** | East Caribbean dollar |
| **ARGENTINA** | Buenos Aires | **Spanish,** English, Italian, German, French | Austral |
| REPÚBLICA ARGENTINA | | | |
| **AUSTRALIA** | Canberra | English, Aboriginal | Dollar |
| COMMONWEALTH OF AUSTRALIA | | | |
| **AUSTRIA** | Vienna | German, Slovene | Schilling |
| REPUBLIK ÖSTERREICH | | | |
| **THE BAHAMAS** | Nassau | English | Dollar |
| THE COMMONWEALTH OF THE BAHAMAS | | | |
| **BAHRAIN** | Manama | **Arabic,** Persian | Dinar |
| DAWLAT AL-BAHRAYN | | | |
| **BANGLADESH** | Dacca | **Bengali,** English | Taka |
| GAMA PRAJĀTANTRĪ BANGLADESH | | | |
| **BARBADOS** | Bridgetown | English | Dollar |
| **BELGIUM** | Brussels | Flemish, French | Franc |
| KONINKRIJK BELGIË ROYAUME DE BELGIQUE | | | |
| **BELIZE** | Belmopan | **English,** Spanish, Creole | Belize dollar |
| **BENIN** | Porto-Novo | **French** | CFA franc |
| RÉPUBLIQUE POPULAIRE DU BENIN | | | |
| **BHUTAN** | Thimphu | **Dzongkha,** Nepali | Ngultrum |
| DRUK-YUL | | | |

● Official languages are shown in **bold** typeface

©DIAGRAM

## Countries of the World: 2

| COUNTRY | CAPITAL | PREDOMINANT LANGUAGES● | CURRENCY |
|---|---|---|---|
| **BOLIVIA** REPÚBLICA DE BOLIVIA | Sucre, La Paz | **Spanish,** Quechua, Aymara | Peso |
| **BOTSWANA** REPUBLIC OF BOTSWANA | Gaborone | **English,** Setswana | Pula |
| **BRAZIL** REPÚBLICA FEDERATIVA DO BRASIL | Brasilia | **Portuguese,** English | Cruzeiro |
| **BRUNEI** NEGARA BRUNEI DARUSSALAM | Bandar Seri Begawan | **Malay,** English | Brunei dollar |
| **BULGARIA** NARODNA REPUBLIKA BULGARIA | Sofia | Bulgarian, Turkish, Greek | Lev |
| **BURKINA FASO** | Ouagadougou | **French,** More, Sudanic tribal | CFA franc |
| **BURMA** PYIDAUNGSU SOCIALIST THAMMADA MYANMA NAINGNGANDAW | Rangoon | **Burmese** | Kyat |
| **BURUNDI** REPUBLIKA Y'UBURUNDI | Bujumbura | **French, Rundi** | Franc |
| **CAMBODIA** CAMBODIAN PEOPLE'S REPUBLIC | Phnom Penh | **Khmer,** French | Riel |
| **CAMEROON** UNITED REPUBLIC OF CAMEROON | Yaounde | **English, French,** Bantu, Sudanic | CFA franc |
| **CANADA** | Ottawa | **English, French** | Dollar |
| **CAPE VERDE** REPUBLICA DE CABO VERDE | Praia | **Portuguese,** Crioulo | Escudo |
| **CENTRAL AFRICAN REPUBLIC** REPUBLIQUE CENTRAFRICAINE | Bangui | **French,** local dialects | CFA franc |
| **CHAD** RÉPUBLIQUE DU TCHAD | N'Djamena | **French,** Arabic | CFA franc |
| **CHILE** REPÚBLICA DE CHILE | Santiago | Spanish | Peso |
| **CHINA** ZHONGHUA RENMIN GONGHE GUO | Peking | **Mandarin Chinese** | Yuan |
| **COLOMBIA** REPÚBLICA DE COLOMBIA | Bogota | Spanish | Peso |
| **COMOROS** JUMHURĪYAT AL-QUMUR AL-ITTHĀDĪYAH AL-ISLĀMĪYAH | Moroni | Shaafi Islam, **French** | CFA franc |

●Official languages are shown in **bold** typeface

©DIAGRAM

## Countries of the World: 3

| COUNTRY | CAPITAL | PREDOMINANT LANGUAGES• | CURRENCY |
|---|---|---|---|
| **CONGO**<br>RÉPUBLIQUE POPULAIRE DU CONGO | Brazzaville | **French,** Bantu dialects | CFA franc |
| **COSTA RICA**<br>REPÚBLICA DE COSTA RICA | San Jose | **Spanish** | Colon |
| **CUBA**<br>REPÚBLICA DE CUBA | Havana | Spanish | Peso |
| **CYPRUS**<br>KIPRIAKI DIMOKRATIA<br>KIBRIS CUMHURIYETI | Nicosia | **Greek, Turkish,** English | Pound |
| **CZECHOSLOVAKIA**<br>ČESKOSLOVENSKÁ SOCIALISTICKÁ REPUBLIKA | Prague | **Czech, Slovak** | Koruna |
| **DENMARK**<br>KONGERIGET DANMARK | Copenhagen | Danish | Krone |
| **DJIBOUTI**<br>JUMHOURIYYA DJIBOUTI | Djibouti | **French, Arabic** | Franc |
| **DOMINICA**<br>COMMONWEALTH OF DOMINICA | Roseau | **English,** French patois | East Caribbean dollar |
| **DOMINICAN REPUBLIC**<br>REPÚBLICA DOMINICANA | Santo Domingo | Spanish | Peso |
| **ECUADOR**<br>REPÚBLICA DEL ECUADOR | Quito | **Spanish,** Quechuan, Jivaroan | Sucre |
| **EGYPT**<br>JUMHŪRĪYAH MISR AL-ARABIYA | Cairo | Arabic, English | Pound |
| **EL SALVADOR**<br>REPÚBLICA DE EL SALVADOR | San Salvador | Spanish, Nahuati | Colon |
| **EQUATORIAL GUINEA**<br>REPÚBLICA DE GUINEA ECUATORIAL | Malabo | **Spanish,** Fang, English | Ekuele |
| **ETHIOPIA**<br>HEBRETASEBAWIT ETYOPIA | Addis Ababa | **Amharic,** Tigre, Galla, Arabic | Birr |
| **FIJI**<br>DOMINION OF FIJI | Suva | **English,** Fijian, Hindustani | Dollar |
| **FINLAND**<br>SUOMEN TASAVALTA | Helsinki | **Finnish, Swedish** | Markka |
| **FRANCE**<br>RÉPUBLIQUE FRANÇAISE | Paris | French | Franc |

•Official languages are shown in **bold** typeface

©DIAGRAM

## Countries of the World: 4

| COUNTRY | CAPITAL | PREDOMINANT LANGUAGES● | CURRENCY |
|---|---|---|---|
| **GABON** RÉPUBLIQUE GABONAISE | Libreville | **French,** Bantu dialects | CFA franc |
| **THE GAMBIA** REPUBLIC OF THE GAMBIA | Banjul | **English,** Mandinka, Wolof | Dalasi |
| **EAST GERMANY** DEUTSCHE DEMOKRATISCHE REPUBLIK | East Berlin | German | Mark |
| **WEST GERMANY** BUNDESREPUBLIK DEUTSCHLAND | Bonn | German | Mark |
| **GHANA** REPUBLIC OF GHANA | Accra | **English,** tribal languages | Cedi |
| **GREECE** ELLINIKI DIMOKRATIA | Athens | Greek | Drachma |
| **GRENADA** STATE OF GRENADA | St George's | **English,** French-African patois | East Caribbean dollar |
| **GUATEMALA** REPÚBLICA DE GUATEMALA | Guatemala City | Spanish, Indian dialects | Quetzal |
| **GUINEA** RÉPUBLIQUE DE GUINÉE | Conakry | **French,** tribal languages | Syli |
| **GUINEA-BISSAU** REPUBLICA DA GUINÉ-BISSAU | Bissau | **Portuguese,** Criolo | Peso |
| **GUYANA** COOPERATIVE REPUBLIC OF GUYANA | Georgetown | **English,** Amerindian dialects | Dollar |
| **HAITI** RÉPUBLIQUE D'HAITI | Port-au-Prince | **French,** Creole | Gourde |
| **HONDURAS** REPUBLICA DE HONDURAS | Tegucigalpa | Spanish, Indian dialects | Lempira |
| **HUNGARY** MAGYAR NÉPKÖZTÁRASÁG | Budapest | Hungarian | Forint |
| **ICELAND** LÝOVELDIO ISLAND | Reykjavik | Icelandic | Krona |
| **INDIA** BHARAT | New Delhi | **Hindi, English,** (16 languages) | Rupee |
| **INDONESIA** REPUBLIK INDONESIA | Jakarta | **Bahasa Indonesian,** Javanese | Rupiah |
| **IRAN** JOMHORI-E-ISLAMI-E-IRÅN | Teheran | Farsi, Turk, Kurdish, Arabic, English, French | Rial |

● Official languages are shown in **bold** typeface

## Countries of the World: 5

| COUNTRY | CAPITAL | PREDOMINANT LANGUAGES. | CURRENCY |
|---|---|---|---|
| **IRAQ** AL JUMHOURIYA AL 'IRAQIA | Baghdad | **Arabic,** Kurdish | Dinar |
| **IRELAND** EIRE | Dublin | English | Pound |
| **ISRAEL** MEDINAT ISRAEL | Jerusalem | **Hebrew and Arabic,** Yiddish | Shekel |
| **ITALY** REPUBBLICA ITALIANA | Rome | Italian | Lira |
| **IVORY COAST** RÉPUBLIQUE DE LA CÔTE D'IVOIRE | Yamoussoukro | **French,** tribal languages | CFA franc |
| **JAMAICA** | Kingston | English, Jamaican Creole | Dollar |
| **JAPAN** NIPPON | Tokyo | Japanese | Yen |
| **JORDAN** AL MAMLAKA AL URDUNIYA AL HASHEMIYAH | Amman | **Arabic,** English | Dinar |
| **KENYA** JAMHURI YA KENYA | Nairobi | **Swahili,** English | Shilling |
| **KIRIBATI** REPUBLIC OF KIRIBATI | Tarawa | **Gilbertese** and **English** | Australian dollar |
| **NORTH KOREA** CHOSUN MINCHU-CHUI INMIN KONGHWA-GUK | Pyongyang | Korean | Won |
| **SOUTH KOREA** TAEHAN MIN'GUK | Seoul | Korean | Won |
| **KUWAIT** DOWLAT AL-KUWAIT | Kuwait | Arabic | Dinar |
| **LAOS** SATHALANALAT PAXATHIPATAI PAXAXÔN LAO | Vientiane | **Lao,** French, English | New Kip |
| **LEBANON** AL-JUMHOURIYA AL-LUBNANIYA | Beirut | **Arabic,** French, Armenian | Pound |
| **LESOTHO** KINGDOM OF LESOTHO | Maseru | English, **Sesotho** | Maloti |
| **LIBERIA** REPUBLIC OF LIBERIA | Monrovia | **English,** tribal dialects | Dollar |
| **LIBYA** AL-JAMAHIRIYAH AL-ARABIYA AL-LIBYA AL-SHABIYA AL-ISHTIRAKIYA | Tripoli | Arabic | Dinar |

• Official languages are shown in **bold** typeface

©DIAGRAM

## Countries of the World: 6

| COUNTRY | CAPITAL | PREDOMINANT LANGUAGES• | CURRENCY |
|---|---|---|---|
| **LIECHTENSTEIN** FÜRSTENTUM LIECHTENSTEIN | Vaduz | **German,** Alemannic dialect | Swiss franc |
| **LUXEMBOURG** GRAND-DUCHÉ DE LUXEMBOURG | Luxembourg | French, German, Luxembourgian | Franc |
| **MADAGASCAR** REPOBLIKA DEMOKRATIKA MALAGASY | Antananarivo | Malagasy, French | Franc |
| **MALAWI** REPUBLIC OF MALAWI | Lilongwe | **English, Chichewa** | Kwacha |
| **MALAYSIA** | Kuala Lumpur | **Malay,** English, Chinese, Indian | Ringgit |
| **MALDIVES** DIVEHI JUMHURIYA | Male | Divehi (Sinhalese dialect) | Rufiyaa |
| **MALI** RÉPUBLIQUE DU MALI | Bamako | **French,** Bambara | Franc |
| **MALTA** REPUBBLIKA TA'MALTA | Valletta | **Maltese, English** | Pound |
| **MAURITANIA** RÉPUBLIQUE ISLAMIQUE DE MAURITANIE | Nouakchott | **French,** Hassanya Arabic | Ouguiya |
| **MAURITIUS** | Port Louis | **English,** French, Creole | Rupee |
| **MEXICO** ESTADOS UNIDOS MEXICANOS | Mexico City | Spanish | Peso |
| **MONACO** PRINCIPALITY OF MONACO | Monaco-Ville | **French** | French franc Monégasque franc |
| **MONGOLIA** BÜGD NAYRAMDAKH MONGOL ARD ULS | Ulaanbaatar | **Khalkha Mongolian,** Russian Chinese | Tugrik |
| **MOROCCO** AL-MAMLAKA AL-MAGHREBIA | Rabat | **Arabic** | Dirham |
| **MOZAMBIQUE** REPUBLICA POPULAR DE MOCAMBIQUE | Maputo | **Portuguese,** Bantu languages | Metical |
| **NAURU** NAOERO | Yaren | **Nauruan,** English | Australian dollar |
| **NEPAL** SRI NEPALA SARKAR | Kathmandu | **Nepali,** 12 others | Rupee |

•Official languages are shown in **bold** typeface

© DIAGRAM

## Countries of the World: 7

| COUNTRY | CAPITAL | PREDOMINANT LANGUAGES● | CURRENCY |
|---|---|---|---|
| **NETHERLANDS** KONINKRIJK DER NEDERLANDEN | Amsterdam | Dutch | Guilder |
| **NEW ZEALAND** | Wellington | **English,** Maori | Dollar |
| **NICARAGUA** REPUBLICA DE NICARAGUA | Managua | Spanish, English | Cordoba |
| **NIGER** RÉPUBLIQUE DU NIGER | Niamey | **French,** Hausa, Djerma | CFA franc |
| **NIGERIA** FEDERAL REPUBLIC OF NIGERIA | Lagos | **English,** Hausa, Yoruba, Ibo | Naira |
| **NORWAY** KONGERIKET NORGE | Oslo | **Norwegian,** Lapp | Krone |
| **OMAN** SALTANAT 'UMAN | Muscat | **Arabic,** English, Urdu | Rial Omani |
| **PAKISTAN** ISLAMIC REPUBLIC OF PAKISTAN | Islamabad | **Urdu, English** | Rupee |
| **PANAMA** REPÚBLICA DE PANAMÁ | Panama | **Spanish,** English | Balboa |
| **PAPUA NEW GUINEA** | Port Moresby | **English,** Melanesian Pidgin | Kina |
| **PARAGUAY** REPUBLICA DEL PARAGUAY | Asunción | **Spanish,** Guarani | Guarani |
| **PERU** REPUBLICA DEL PERU | Lima | **Spanish, Quechua** | Sol |
| **PHILIPPINES** REPUBLIC OF THE PHILIPPINES | Quezon City, Manila | **Philipino, English** | Peso |
| **POLAND** POLSKA RZECZPOSPOLITA LUDOWA | Warsaw | Polish | Zloty |
| **PORTUGAL** RÉPUBLICA PORTUGUESA | Lisbon | Portuguese | Escudo |
| **QATAR** DAWLET AL-QATAR | Doha | **Arabic,** English | Riyal |
| **ROMANIA** REPUBLICA SOCIALISTĂ ROMÂNIA | Bucharest | Romanian, Hungarian, German | Leu |
| **RWANDA** REPUBLIKA Y'U RWANDA | Kigali | **French, Kinyarwandu** | Franc |

● Official languages are shown in **bold** typeface

© DIAGRAM

## Countries of the World: 8

| COUNTRY | CAPITAL | PREDOMINANT LANGUAGES● | CURRENCY |
|---|---|---|---|
| **ST. CHRISTOPHER (ST. KITTS) AND NEVIS** | Basseterre | English | East Caribbean dollar |
| ST. CHRISTOPHER NEVIS | | | |
| **SAINT LUCIA** | Castries | **English**, French patois | East Caribbean dollar |
| **ST VINCENT AND THE GRENADINES** | Kingstown | English | East Caribbean dollar |
| **SAN MARINO** | San Marino | Italian | Italian lira |
| SERENISSIMA REPUBLICA DI SAN MARINO | | | |
| **SAO TOME AND PRINCIPE** | Sao Tome | Portuguese | Dobra |
| REPÚBLICA DEMOCRÁTICA DE SAO TOME E PRINCIPE | | | |
| **SAUDI ARABIA** | Riyadh | Arabic | Riyal |
| AL-MAMALAKA AL-'ARABIYA AS-SA'UDIYA | | | |
| **SENEGAL** | Dakar | **French**, tribal languages | CFA franc |
| RÉPUBLIQUE DU SÉNÉGAL | | | |
| **SEYCHELLES** | Victoria | **English and French** | Rupee |
| REPUBLIC OF SEYCHELLES | | | |
| **SIERRA LEONE** | Freetown | **English**, tribal languages | Leone |
| REPUBLIC OF SIERRA LEONE | | | |
| **SINGAPORE** | Singapore | **Chinese, Malay, Tamil, English** | Dollar |
| REPUBLIC OF SINGAPORE | | | |
| **SOLOMON ISLANDS** | Honiara | **English**, Pidgin | Dollar |
| **SOMALIA** | Mogadishu | **Somali, Arabic** | Shilling |
| JAMHURIYADDA DIMUGRADIGA SOMALIYA | | | |
| **SOUTH AFRICA** | Cape Town | **Afrikaans, English** | Rand |
| REPUBLIEK VAN SUID-AFRIKA | | | |
| **SPAIN** | Madrid | **Spanish**, Catalan | Peseta |
| ESPAÑA | | | |
| **SRI LANKA** | Colombo | **Sinhala**, Tamil, English | Rupee |
| SRI LANKA PRAJATHANTHRIKA SAMAJAVADI JANARAJAYA | | | |
| **SUDAN** | Khartoum | **Arabic**, tribal languages | Pound |
| JAMHURYAT AS-SUDAN | | | |

● Official languages are shown in **bold** typeface

## Countries of the World: 9

| COUNTRY | CAPITAL | PREDOMINANT LANGUAGES● | CURRENCY |
|---|---|---|---|
| **SURINAME** REPUBLIC OF SURINAME | Paramaribo | **Dutch,** Sranan, English | Guilder |
| **SWAZILAND** KINGDOM OF SWAZILAND | Mbabane | **Siswati, English** | Lilangeni |
| **SWEDEN** KONUNGARIKET SVERIGE | Stockholm | Swedish, Finnish | Krona |
| **SWITZERLAND** SWISS CONFEDERATION | Bern | **German, French, Italian** | Franc |
| **SYRIA** AL-JAMHOURIYA AL ARABIA AS-SOURIYA | Damascus | **Arabic,** Kurdish, Armenian | Pound |
| **TAIWAN** CHUNG-HUA MIN-KUO | Taipei | **Mandarin Chinese,** Taiwan, Hakka dialects | New Taiwan dollar |
| **TANZANIA** JAMHURI YA MWUNGANO WA TANZANIA | Dar-es-Salaam | **Swahili, English** | Shilling |
| **THAILAND** MUANG THAI OR PRATHET THAI | Bangkok | Thai | Baht |
| **TOGO** RÉPUBLIQUE TOGOLAISE | Lomé | **French** | CFA franc |
| **TONGA** PULE 'ANGA TONGA | Nuku'alofa | Tongan, English | Pa'anga |
| **TRINIDAD AND TOBAGO** REPUBLIC OF TRINIDAD AND TOBAGO | Port-of-Spain | **English,** Hindi, French, Spanish | Dollar |
| **TUNISIA** AL JUMHURIYAH AT-TUNISIYAH | Tunis | **Arabic,** French | Dinar |
| **TURKEY** TURKIYE CUMHURIYETI | Ankara | **Turkish,** Kurdish, Arabic | Lira |
| **TUVALU** | Funafuti | Tuvaluan, English | Australian dollar |
| **UGANDA** REPUBLIC OF UGANDA | Kampala | **English,** Luganda, Swahili | Shilling |
| **UNION OF SOVIET SOCIALIST REPUBLICS** SOYUZ SOVETSKYKH SOTSIALISTICHESKIKH RESPUBLIC | Moscow | Russian | Ruble |

©DIAGRAM

● Official languages are shown in **bold** typeface

## Countries of the World: 10

| COUNTRY | CAPITAL | PREDOMINANT LANGUAGES● | CURRENCY |
|---|---|---|---|
| **UNITED ARAB EMIRATES** | Abu Dhabi | **Arabic,** Farsi, English, Hindi, Urdu | Dirham |
| ITTIHĀD AL-IMARAT AL-ARABIYAH | | | |
| **UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND** | London | English, Welsh, Gaelic | Pound |
| **UNITED STATES OF AMERICA** | Washington DC | English | Dollar |
| **URUGUAY** | Montevideo | Spanish | New Peso |
| REPÚBLICA ORIENTAL DEL URUGUAY | | | |
| **VANUATU** | Vila | Bislama, **French** and **English** | Australian dollar Vanuatu franc |
| RIPABLIK BLONG VANUATU | | | |
| **VATICAN CITY** | Vatican City | Italian, Latin | Lira |
| STATE OF THE VATICAN CITY | | | |
| **VENEZUELA** | Caracas | **Spanish,** Indian languages | Bolivar |
| REPUBLICA DE VENEZUELA | | | |
| **VIETNAM** | Hanoi | **Vietnamese,** French, English | Dong |
| CONG HOA XA HOI CHU NGHIA VIET NAM | | | |
| **WESTERN SAMOA** | Apia | **Samoan, English** | Tala |
| MALOTUTO'ATASI O SAMOA I SISIFO | | | |
| **NORTH YEMEN** | Sanaa | Arabic | Rial |
| AL-JUMHURIYAT AL-ARABIYAH AL-YAMANIYAH | | | |
| **SOUTH YEMEN** | Aden | Arabic | Dinar |
| JUMHURIYAT AL-YAMAN AD-DIMUQRATIYAH ASH-SHA'BIYAN | | | |
| **YUGOSLAVIA** | Belgrade | **Serbo-Croatian, Macedonian, Slovenian** | Dinar |
| SOCIJALISTIČKA FEDERATIVNA REPUBLIKA JUGOSLAVIJA | | | |
| **ZAIRE** | Kinshasa | **French,** Bantu dialects | Zaire |
| RÉPUBLIQUE DU ZAÏRE | | | |
| **ZAMBIA** | Lusaka | **English,** Bantu dialects | Kwacha |
| REPUBLIC OF ZAMBIA | | | |
| **ZIMBABWE** | Harare | **English,** Shona, Sindebele | Dollar |

©DIAGRAM

● Official languages are shown in **bold** typeface
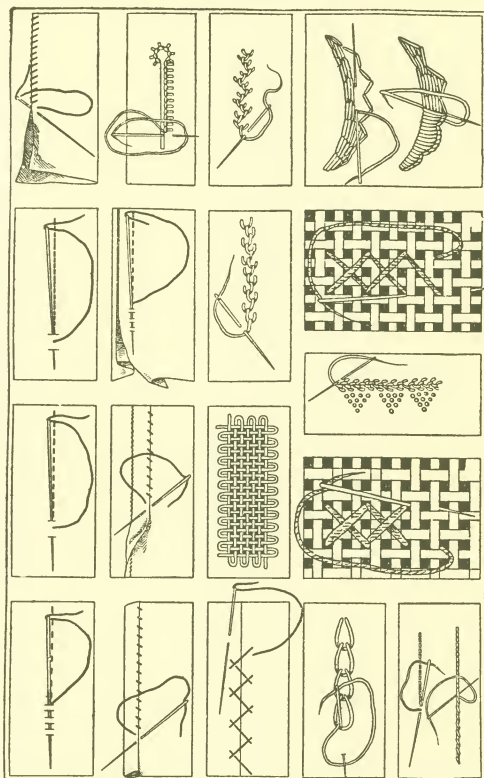
## Location of organs

FRONT                                    BACK

1
2
3
4
5
6
7
8
9
10
11
12
13
14

15
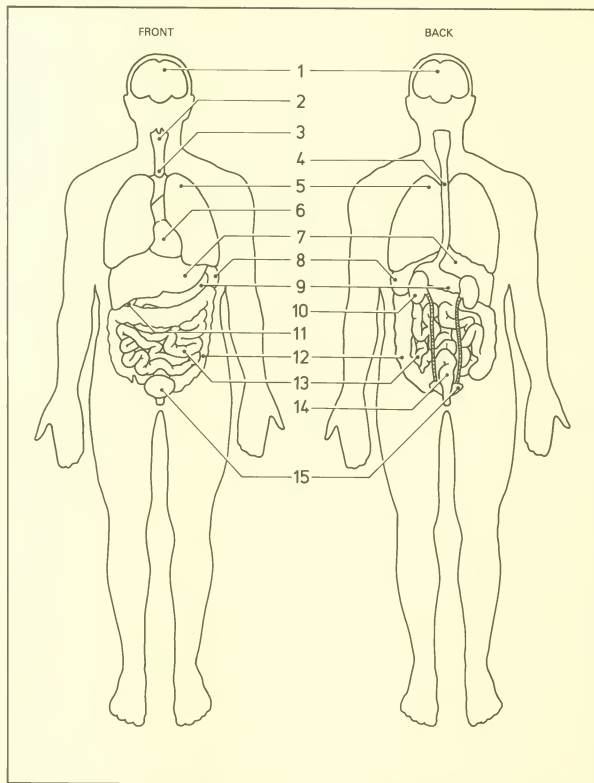
©DIAGRAM

| | | |
|---|---|---|
| **1** Brain | **9** Stomach | |
| **2** Larynx | **10** Kidney | |
| **3** Trachea | **11** Gall bladder | |
| **4** Esophagus | **12** Large intestine | |
| **5** Lungs | **13** Small intestine | |
| **6** Heart | **14** Rectum | |
| **7** Liver | **15** Bladder | |
| **8** Spleen | | |

## Size and weight of organs
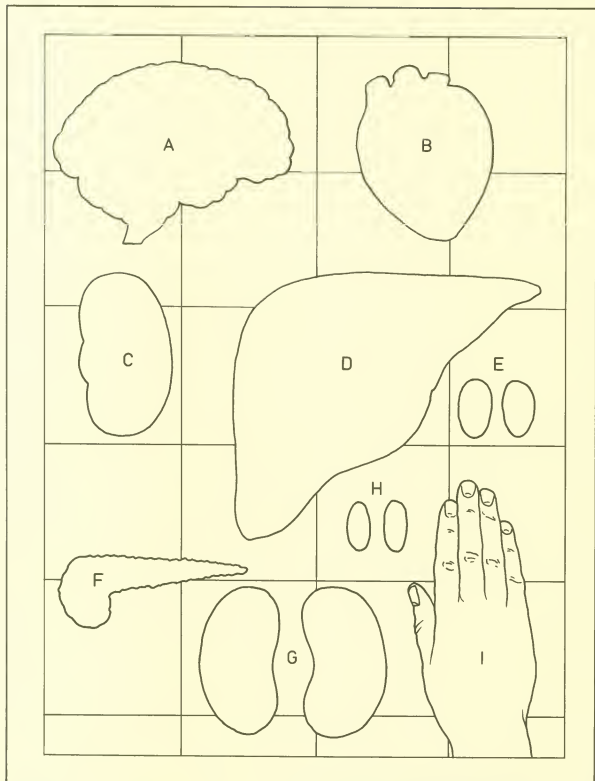
A Brain 3lb
B Heart 9.8oz
C Spleen 7oz
D Liver 3lb 1oz
E Testes 0.4oz each (men)
F Pancreas 2.9oz
G Kidneys 4.9oz each
H Ovaries 0.1oz each (women)
I Average size man's hand

Each square on grid represents 5 square inches.
Size and weights are based on average man.
Organs in women and children are comparatively
smaller.

©DIAGRAM

## Dental chart
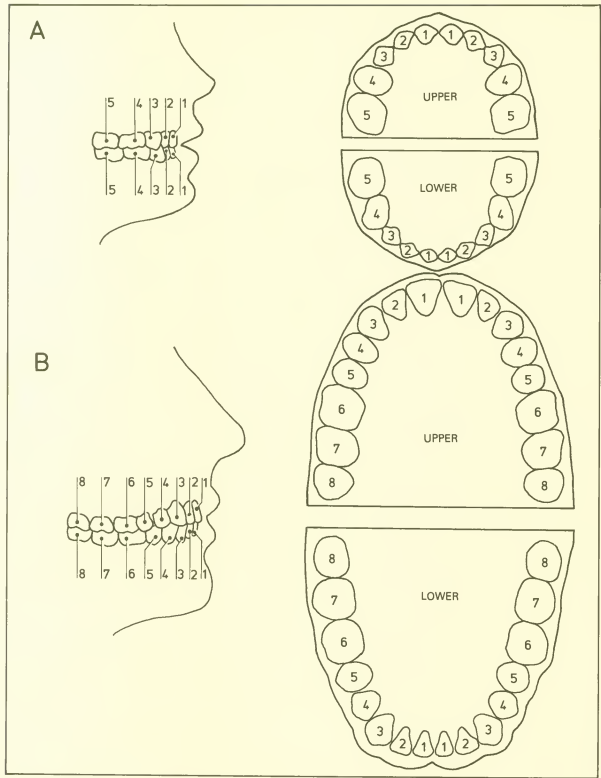
**A Primary teeth**
1 Central incisor
2 Lateral incisor
3 Canine
4 First molar
5 Second molar
**B Permanent teeth**
1 Central incisor
2 Lateral incisor
3 Canine

4 First premolar
5 Second premolar
6 First molar
7 Second molar
8 Third molar (wisdom tooth)

©DIAGRAM

## Growth charts: children

GIRLS

GIRLS

BOYS

BOYS

Age

Height / inches

Weight / pounds

NORMAL RANGE

NORMAL RANGE

NORMAL RANGE

NORMAL RANGE

©DIAGRAM
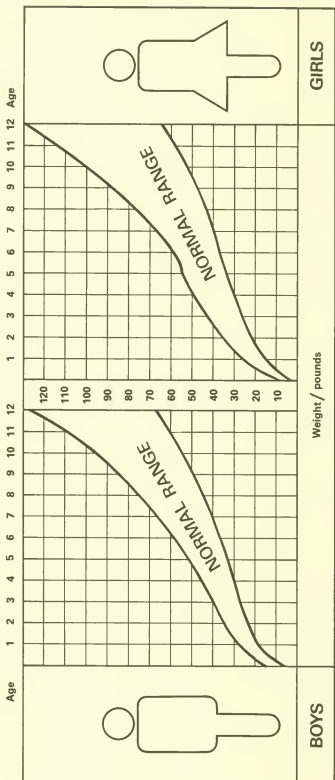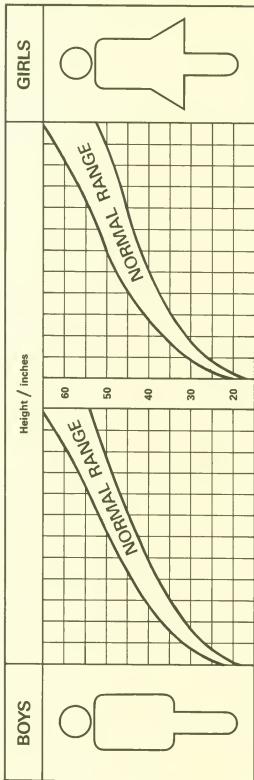
## Weight/height ratio: men and women
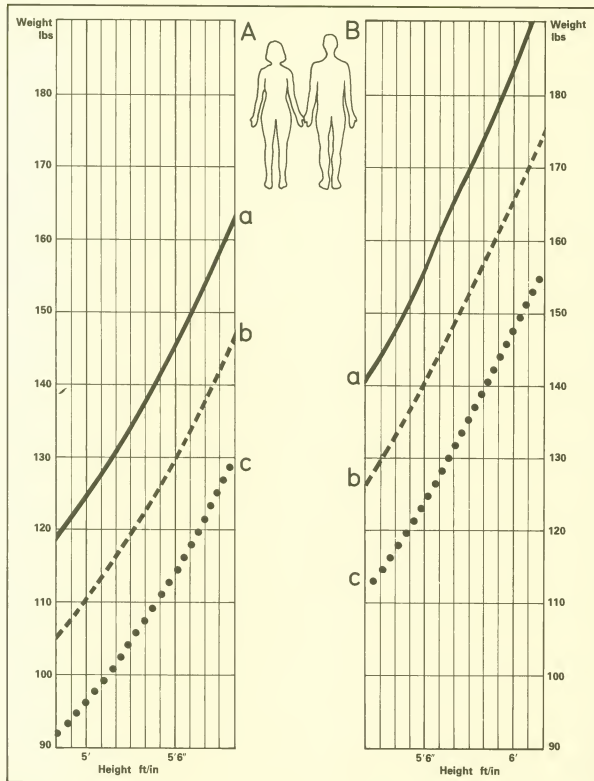
A Women
B Men
a Large frame
b Medium frame
c Small frame

## Pulse rate: body temperature

Average beats per minute

| Unborn child 140 to 150 |
| Newborn baby 130 to 140 |
| First year 110 to 130 |
| Second year 96 to 115 |
| Third year 86 to 105 |
| 7–14 years 76 to 90 |
| 14–21 years 76 to 85 |
| 21–60 years 70 to 75 |
| After 60 years 67 to 80 |

Approximate temperature (F)

©DIAGRAM
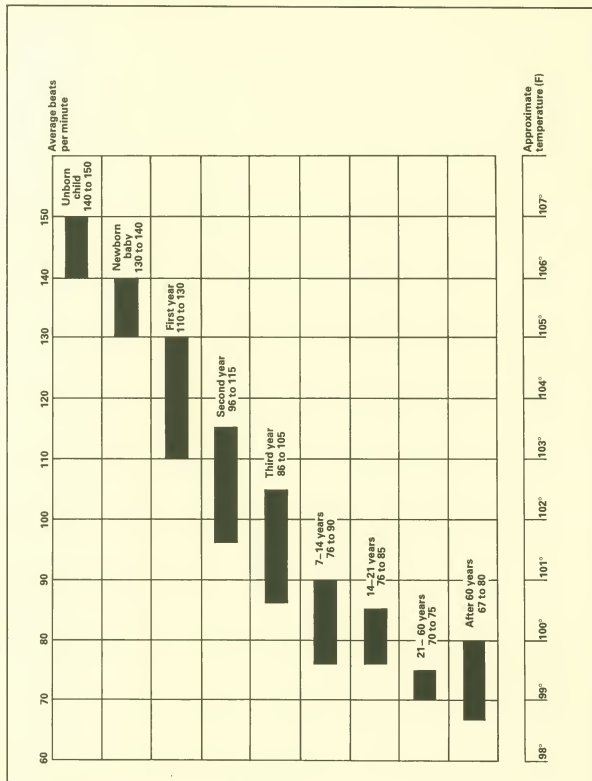
## Blood pressure: average normal pressures by age
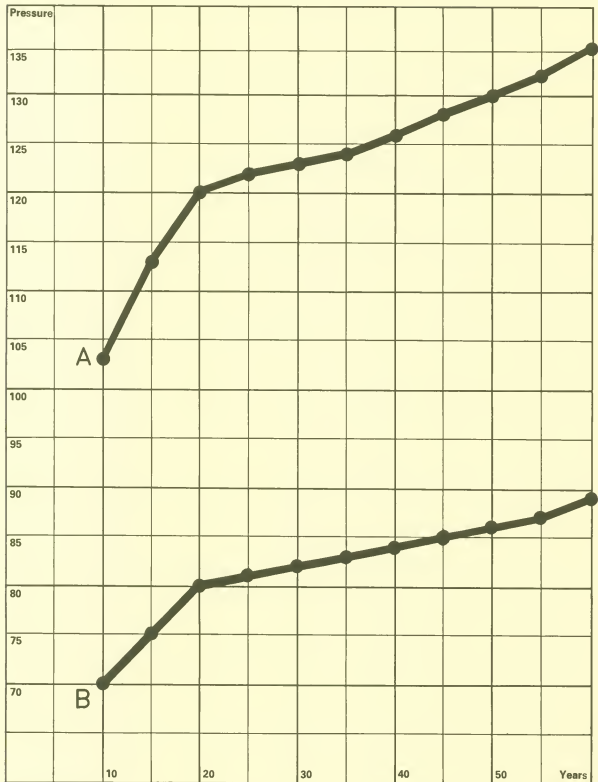
A Systolic pressure
B Diastolic pressure

## Blood groups: parents and children

| | 1 | 2 | 3 |
|---|---|---|---|
| | A x A | A.O | B.AB |
| | A x B | A.B.O.AB | None |
| | A x AB | A.B.AB | O |
| | A x O | A.O | B.AB |
| | B x B | B.O | A.AB |

| | 1 | 2 | 3 |
|---|---|---|---|
| | B x AB | A.B.AB | O |
| | B x O | B.O | A.AB |
| | AB x AB | A.B.AB | O |
| | AB x O | A.B | AB.O |
| | O x O | O | A.B.AB |

1 Parents' blood group
2 Child's blood group
3 Impossible blood group of child

©DIAGRAM

## Blood groups: donors and recipients

1 Donors
2 Recipients
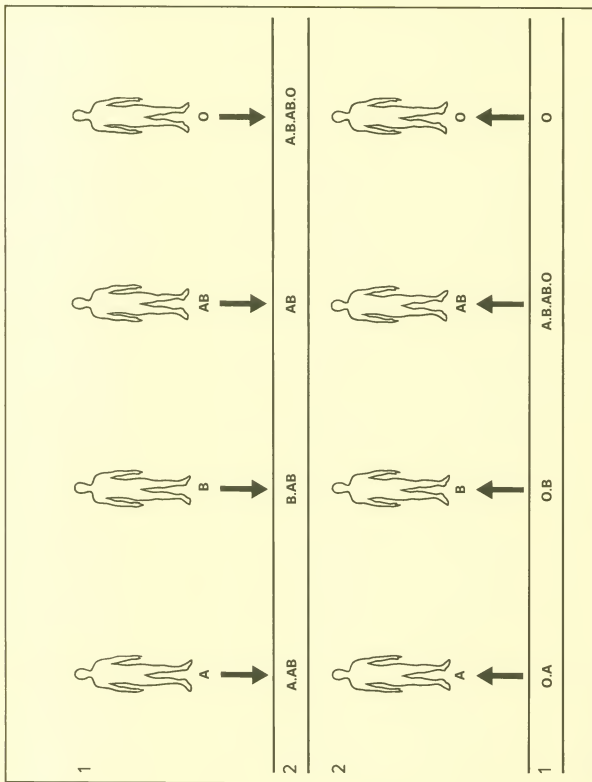
©DIAGRAM

## Immunization schedule for children

- ● Injection
- ○ Booster
- ☐ Oral vaccine

| | MONTHS | | | | YEARS | |
| --- | --- | --- | --- | --- | --- | --- |
| | 3 | 4½-5 | 8½-11 | 12-24 | 4-5 | 11-13 |
| DIPHTHERIA | ● | ● | ● | | ○ | |
| WHOOPING COUGH | ● | ● | ● | | | |
| TETANUS | ● | ● | ● | | ○ | |
| POLIOMYELITIS | ☐ | ☐ | ☐ | | ☐ | |
| MEASLES | | | | ● | | |
| MUMPS | | | | ● | | |
| GERMAN MEASLES | | | | ● | | |
| TUBERCULOSIS | | | | | | ● |

©DIAGRAM

## Calories: requirements and energy expenditure

**DAILY CALORIE INTAKE**

| 3000 | 2000 | 1000 | 0 Years |
|------|------|------|---------|
| | | | Up to 1 |
| | | | 1–2 |
| | | | 2–3 |
| MALE | | | 3–5 |
| | | | 5–7 |
| | | | 7–9 |
| | | | 9–12 |
| | | | 12–15 |
| | | | 15–18 |
| | | | Adult |
| | | | After retirement |

| 3000 | 2000 | 1000 | 0 Years |
|------|------|------|---------|
| | | | Up to 1 |
| | | | 1–2 |
| | | | 2–3 |
| FEMALE | | | 3–5 |
| | | | 5–7 |
| | | | 7–9 |
| | | | 9–12 |
| | | | 12–15 |
| | | | 15–18 |
| | | | Adult |
| | | | Pregnancy |
| | | | Breast feeding |
| | | | After retirement |
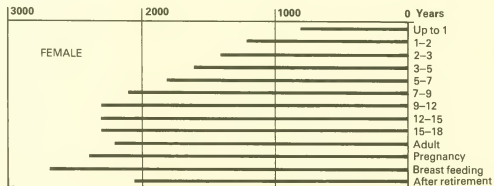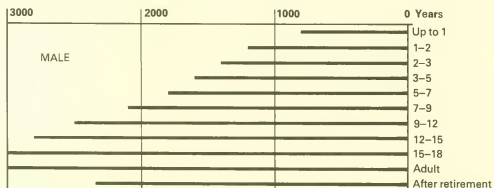
**CALORIES USED IN AVERAGE DAY  (Male office worker)**

| 600 | 500 | 400 | 300 | 200 | 100 | 0 |
|-----|-----|-----|-----|-----|-----|---|
| | | | | | | Sleeping: 8 hrs |
| | | | | | | Washing, light domestic: 2 hrs |
| | | | | | | Traveling: 2 hrs |
| | | | | | | Standing, walking: 3 hrs |
| | | | | | | Sitting: 5 hrs |
| | | | | | | Eating, watching TV: 3 hrs |
| | | | | | | Exercise, gardening: 1 hr |
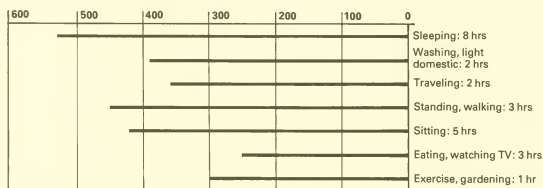
# Human expenditure of energy

| Activity | Rate in calories per 15 minutes |
|---|---|
| Rest in bed | 15 |
| Sitting | 27 |
| Sitting and writing | 28 |
| Standing | 30 |
| Driving a car | 42 |
| Washing up | 50 |
| Driving a motorcycle | 51 |
| Dressing | 53 |
| Bedmaking | 105 |
| Walking | 123 |
| Climbing stairs | 155 |
| Bicycling | 165 |
| Running (5 mph) | 213 |
| Rowing | 285 |
| Swimming | 303 |
| Skiing | 393 |

Rate in calories per 15 minutes

© DIAGRAM

## Exercise : body types

| Strength | Suppleness | Stamina | | Ectomorph | Mesomorph | Endomorph |
|:---:|:---:|:---:|:---|:---:|:---:|:---:|
| ○ | ○ | | Calisthenics | ● | ● | |
| | ○ | | Yoga | ● | ● | ● |
| | ○ | | Stretching | ● | ● | ● |
| ○ | ○ | ○ | Dancing | ● | ● | ● |
| ○ | | | Weight training | | ● | |
| ○ | ○ | ○ | Aerobics | ● | ● | |
| | | ○ | Walking | ● | ● | ● |
| | | ○ | Jogging | ● | ● | |
| | | ○ | Jumping rope | ● | ● | |
| | | ○ | Cycling | ● | ● | ● |
| ○ | | ○ | Racket sports | ● | ● | |
| ○ | ○ | ○ | Swimming | | ● | ● |
| ○ | ○ | ○ | Skiing | | ● | |
| ○ | ○ | ○ | Martial arts | | ● | |

©DIAGRAM

A Most suitable exercises for developing strength, stamina and suppleness
B Most suitable exercises for different body types

## Exercise: type of benefit

**Legend:**
- △ Muscle strength
- ■ Muscle endurance
- ▲ Mobility and flexibility
- □ Heart/lung endurance

**Activities:** Baseball, Basketball, Beam (gymnastics), Boxing, Cross-country running, Fencing, Field hockey, Floor exercises (gymnastics), Football, Handball, High jump, Horizontal bar (gymnastics), Horse (gymnastics), Ice hockey, Judo, Karate, Long jump, Parallel bars (gymnastics), Pole vault, Racketball, Rings (gymnastics), Rowing, Skiing (cross-country), Sprinting, Soccer, Squash, Swimming, Tennis, Throwing events, Volleyball, Water polo, Water skiing, Weightlifting, Wrestling

**Benefit regions (body areas):** Legs, Hips, Arms, Trunk, Back, Shoulders, Heart and lungs



©DIAGRAM

## Drugs and their effects

Strychnine

Amphetamines

Antidepressants

Hallucinogens

EYE REACTION
Dilated pupil

Normal

Constricted pupil

Marijuana

Tranquilizers

Alcohol

Narcotics

Barbiturates

**DEATH**

Convulsions

Nervous tremors

Palpitations

Euphoria

STIMULATION

**NORMAL**

Sedation

Drowsiness

Sleep

Loss of pain

Addiction

Loss of sensation

Convulsions

DEPRESSION

**DEATH**

©DIAGRAM
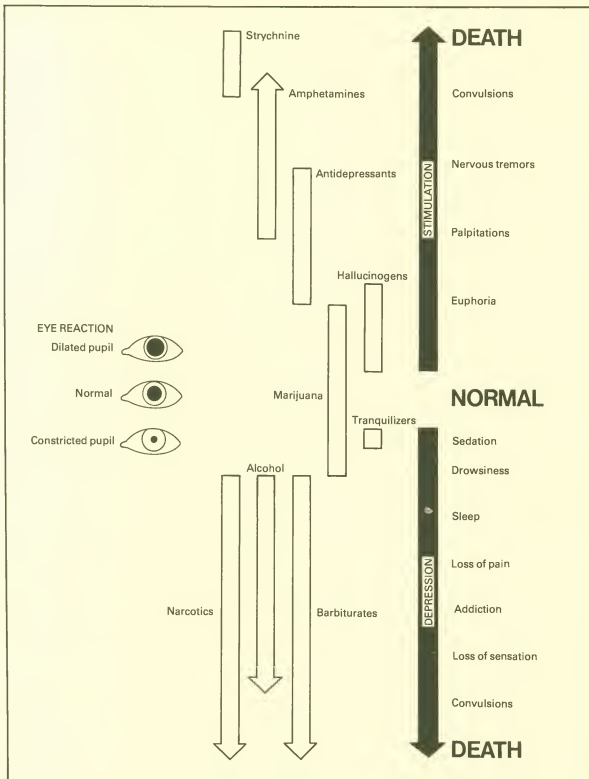
## Cuts of meat: beef and chicken
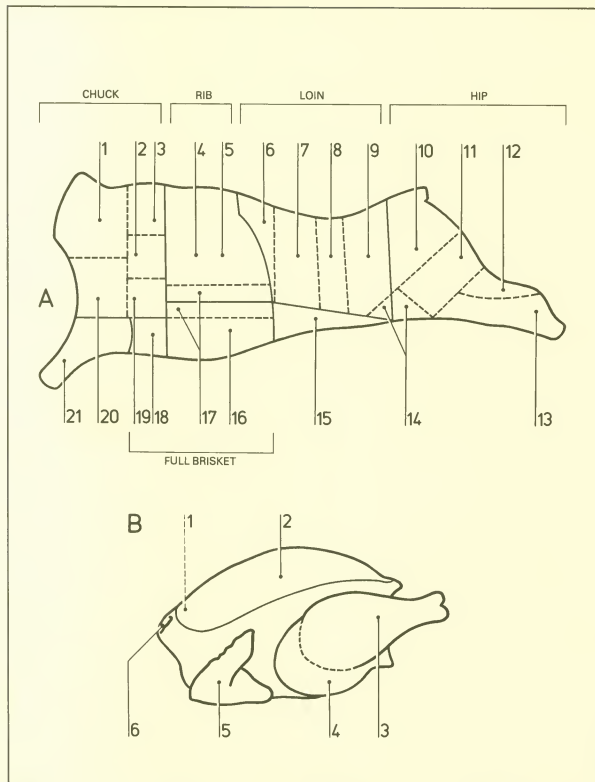
| **A Beef** | **9** Sirloin | **18** Brisket | **B Chicken** |
|---|---|---|---|
| **1** Neck | **10** Rump | **19** Cross rib | **1** Wishbone |
| **2** Chuck short rib | **11** Round | **20** Shoulder | **2** Breast |
| **3** Blade | **12** Heel of round | **21** Front shank | **3** Drumstick (leg) |
| **4** Rib eye | **13** Hind shank | | **4** Thigh |
| **5** Rib | **14** Sirloin tip | | **5** Wing |
| **6** Wing | **15** Flank | | **6** Neck |
| **7** T-bone | **16** Plate | | |
| **8** Porterhouse | **17** Short ribs | | |

©DIAGRAM

## Cuts of meat: pork and lamb
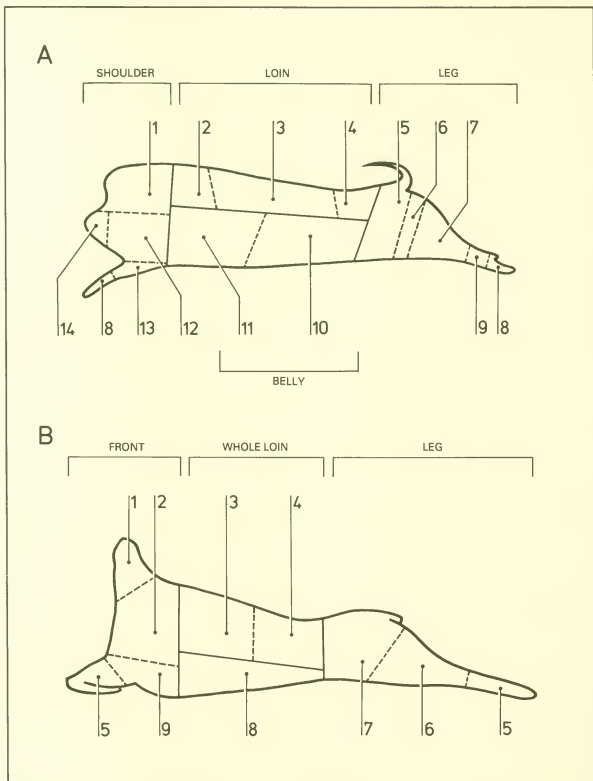
**A**

SHOULDER | LOIN | LEG

BELLY

**B**

FRONT | WHOLE LOIN | LEG

| A Pork | | B Lamb |
|---|---|---|
| 1 Shoulder butt | 10 Side | 1 Neck |
| 2 Rib portion | 11 Side rib | 2 Shoulder |
| 3 Center cut | 12 Picnic shoulder | 3 Rib |
| 4 Tenderloin portion | 13 Hock | 4 Loin |
| 5 Butt | 14 Jowl | 5 Shank |
| 6 Center cut | | 6 Shank portion |
| 7 Shank portion | | 7 Butt portion |
| 8 Foot | | 8 Flank |
| 9 Shank | | 9 Breast |

©DIAGRAM

## Food: meat roasting times

| Type of meat | | Oven Temperature (°F) | Cooking Time (minutes per pound) | Meat Thermometer Reading (°F) |
|---|---|---|---|---|
| **BEEF** | Standing rib | 325° | Rare 23–25 / Medium 27–30 / Well done 32–35 | Rare 140° / Medium 160° / Well done 180° |
| | Rolled rib | 325° | Rare 28–30 / Medium 32–35 / Well done 40–45 | Rare 140° / Medium 160° / Well done 180° |
| | Sirloin, rump, eye of round | 325° | Rare 18–20 / Medium 22–25 / Well done 30–35 | Rare 140° / Medium 160° / Well done 180° |
| | Tenderloin | 425° | 45–60 in total | Usually served rare |
| **LAMB** | Leg, loin, shoulder | 325° | Medium 15–20 / Well done 25–30 | Medium 150° / Well done 180° |
| | Crown | 325° | 2 hours total | Usually served medium |
| **PORK** | Loin | 350° | Well done 45 | 185° |
| | Shoulder | 350° | Well done 50 | 185° |
| **POULTRY** | Chicken | 325° | Well done 25–30 | 180° |
| | Turkey | 325° | Well done 20–25 | 180° |
| | Duck | 325° | Well done 20–25 | 175° |
| | Goose | 325° | Well done 25–30 | 175° |

Minutes: 0 — 15 — 30 — 45 — 60

©DIAGRAM

# Food: storage times in refrigerator

06.019

| | DAYS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MEAT** | | | | | | | | | | | | | | | |
| Bacon | | | | | | | | 7 | | | | | | | |
| Brain | | 1 | | | | | | | | | | | | | |
| Corned beef | | | | | | 5 | | | | | | | | | |
| Ham (sliced) | | | | | | 5 | | | | | | | | | |
| Ham (whole cured) | | | | | | | | | | | | | | | 14 |
| Kidney | | 1 | | | | | | | | | | | | | |
| Liver | | 1 | | | | | | | | | | | | | |
| Meat cuts (fresh) | | | | 3 | | | | | | | | | | | |
| Minced meat | | 1 | | | | | | | | | | | | | |
| Poultry | | | 2 | | | | | | | | | | | | |
| **FISH** | | | 2 | | | | | | | | | | | | |
| **FRUIT** | | | | | | | | | | | | | | | |
| Apples | | | | | | | | 7 | | | | | | | |
| Apricots | | | | | | 5 | | | | | | | | | |
| Berries | | | 2 | | | | | | | | | | | | |
| Cherries | | | | 3 | | | | | | | | | | | |
| Grapefruit | | | | | | | | 7 | | | | | | | |
| Grapes | | | | 3 | | | | | | | | | | | |
| Lemons | | | | | | | | 7 | | | | | | | |
| Oranges | | | | | | 5 | | | | | | | | | |
| Peaches | | | | 3 | | | | | | | | | | | |
| **VEGETABLES** | | | | | | | | | | | | | | | |
| Asparagus | | 1 | | | | | | | | | | | | | |
| Broccoli | | 1 | | | | | | | | | | | | | |
| Brussels sprouts | | 1 | | | | | | | | | | | | | |
| Cabbage | | | | | | 5 | | | | | | | | | |
| Cauliflower | | | | | | 5 | | | | | | | | | |
| Carrots | | | | | | 5 | | | | | | | | | |
| Celery | | | | | | 5 | | | | | | | | | |
| Green leaf vegetables | | 1 | | | | | | | | | | | | | |
| Green onions | | 1 | | | | | | | | | | | | | |
| Lettuce | | 1 | | | | | | | | | | | | | |
| Peas | | 1 | | | | | | | | | | | | | |
| Spinach | | 1 | | | | | | | | | | | | | |
| Tomatoes | | 1 | | | | | | | | | | | | | |
| **DAIRY PRODUCTS** | | | | | | | | | | | | | | | |
| Butter | | | | | | | | | | | | | | | 14 |
| Cheese (hard) | | | | | | | | | | | | | | | 14 |
| Cheese (soft) | | | | | | | | | | | | | | | 14 |
| Cottage cheese | | | | 3 | | | | | | | | | | | |
| Cream | | | | 3 | | | | | | | | | | | |
| Eggs | | | | | | 5 | | | | | | | | | |
| Milk | | | | 3 | | | | | | | | | | | |

©DIAGRAM

## Herbs

1 **Basil** Best with tomatoes, tomato sauces and salads.
2 **Chives** Best as a garnish, in salads and cold soups.
3 **Dill** The seeds are best used in pickles; the leaves with vegetables, fish and cold soups.
4 **Marjoram** Can be used instead of oregano. Best with green vegetables, chicken and salads.
5 **Mint** Best used for mint sauce or jelly with lamb. Excellent with fruit drinks.
6 **Oregano** A favorite in Italian dishes. Good in soups and salads.

7 **Parsley** Often used as a garnish. Good in white sauces, stews and cooked vegetables.
8 **Rosemary** Best with lamb.
9 **Sage** Good with pork. Best in stuffings, meat loaves and sausages.
10 **Savory** Good with bean salads and dishes.
11 **Tarragon** Good with fish, chicken and for flavoring vinegar.
12 **Thyme** Best in stews and stuffings.

©DIAGRAM

## Spices

| | | |
|---|---|---|
| | **Allspice** | Flavor like a blend of cinnamon, cloves and nutmeg. Use in stews, sauces and marinades. |
| | **Anise** | Licorice flavor. Use sparingly in cookies and candies. |
| | **Bay leaf** | Use in stews, sauces, marinades and pickling. |
| | **Caraway** | Seeds used in baking and cooking, especially sauerkraut. |
| | **Cardamom** | Use pod and seeds whole in spicy dishes like curries. |
| | **Cinnamon** | Use for flavoring cookies, puddings (especially apple dishes) and hot drinks. |
| | **Cloves** | Use whole in fruit dishes, baked ham and marinades. |
| | **Coriander** | Use whole seeds in pickles; ground coriander in curries and spicy dishes. |
| | **Cumin** | Use ground in curries and hot spicy dishes. |
| | **Ginger** | Use to spice cookies, cakes, preserves and meat and vegetable dishes. Best used fresh. |
| | **Mace** | The skin of the nutmeg shell. Use as a seasoning in meat, vegetable and fish dishes. |
| | **Nutmeg** | Best used freshly grated with most dishes and hot drinks. |
| | **Pepper** | Best used freshly ground. White is usually used in light-colored dishes. Black pepper is picked as an underripe berry and dried; white is picked ripe. Paprika is a milder red pepper; chilli and cayenne are hotter. |
| | **Saffron** | A cultivated yellow crocus. Use for coloring and flavoring in baking, rice dishes. |
| | **Vanilla** | Use seed pods for flavoring in puddings and baking. |

# Wine: identification of bottles and labels

BOTTLE SHAPES AND COLOR



Chianti
Light green

Champagne
Green

Côtes de Provence
Green

Alsace
Light green

Mosel
Green

Hock
Brown

Burgundy
Green

White Bordeaux
Clear

Red Bordeaux
Green

EUROPEAN WINE LABEL TERMS

FRANCE   **Appellation Contrôlée** official guarantee of how it is produced, grapes used and where it comes from.
**Château** refers to estate or vineyard.
**Mise en bouteille au Château** bottled at the vineyard.
**Vins de pays** ordinary, local wine.

GERMANY **QmP (Qualitätswein mit Prädikat)** is considered the best. **QbA (Qualitätswein bestimmter Anbaugebiete)** next best.
**Tafelwein** ordinary dinner wine.
The best wines carry name of the vineyard **(Einzellage)** or group of vineyards **(Grosslage)**.

ITALY   **DOC (Denominazione di Origine Controllata)** official guarantee.
**Classico** means central part of particular region.
Name of wine may be region where it is produced or kind of grape.

SPAIN   **Rioja** is the best wine region. **Reserva** a good quality wine. **Bodega** a firm producing wines. **Denominacón de origen** is an official wine region.

©DIAGRAM

## Wine: serving temperatures

Temperature scale (°F): 40° F — DOMESTIC FRIDGE TEMPERATURE — 45 — CELLAR TEMPERATURE — 50 — 55 — 60 — ROOM TEMPERATURE

Categories: SWEET WHITES · DRY WHITES · LIGHT REDS · FULL-BODIED REDS

Wines listed:
Muscadet, Vouvray, Chablis, Mâcon, Graves, Beaujolais, Chinon, Valpolicella, Soave, White Burgundy, Côtes du Rhône (red), Red Burgundy, Sauternes, Gewürztraminer, Muscats, Sancerre, Pouilly, Sparkling wine, Champagne, Lambrusco, Tafelwein, Liebfraumilch, Frascati, Orvieto, Vinho Verde, Yugoslav Riesling, Chenin Blanc, Chardonnay, Vin Rose, Retsina, California Sauvignon Blanc, California Chardonnay, California Burgundy, California Pinot Noir, California Cabernet, Bull's Blood, Light Zinfandels, Red Bordeaux, Chianti, Vintage Port, Rioja, Barolo

©DIAGRAM

## Glindesses

1 Martini/Cocktail
2 Sherry
3 Champagne
4 Champagne
5 Punch
6 Beer mug
7 Iced tea
8 Water goblet
9 Water tumbler
10 Juice
11 Old-fashioned
12 Highball
13 Spirit shot
14 All purpose wine glass
15 All purpose wine glass
16 White wine
17 Hock
18 Red wine
19 Liqueur
20 Brandy

©DIAGRAM

## Formal dinner setting
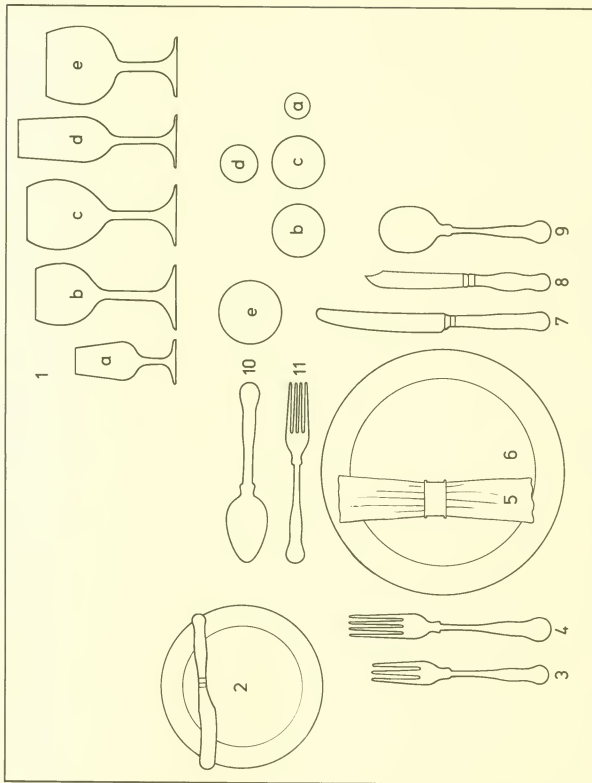
1 Glasses
 a Sherry
 b White wine
 c Red wine
 d Champagne
 e Water
2 Butter plate and knife
3 Fish fork
4 Main course fork
5 Napkin
6 Dinner plate
7 Main course knife
8 Fish knife
9 Soup spoon
10 Dessert spoon
11 Dessert fork

## Conversion tables: basic units

---

### DISTANCE

Miles

| 0 | | 10 | | 20 | | 30 | | 40 | | 50 | | 60 | | 70 | | 80 | | 90 | 100 |

| | 10 | | 20 | | 30 | | 40 | | 50 | | 60 | | 70 | | 80 | | 90 | | 100 | | 110 | | 120 | | 130 | | 140 | | 150 |
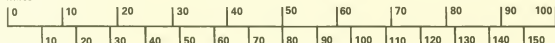
Kilometers

To convert miles to kilometers: multiply by 1.609
To convert kilometers to miles: multiply by 0.62137

---

### SPEED

MPH

| 0 | | 10 | | 20 | | 30 | | 40 | | 50 | | 60 | | 70 | | 80 | | 90 | 100 |

| | 10 | | 20 | | 30 | | 40 | | 50 | | 60 | | 70 | | 80 | | 90 | | 100 | | 110 | | 120 | | 130 | | 140 | | 150 |
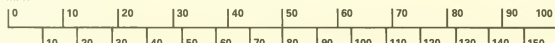
KM/H

---

### TEMPERATURE

Fahrenheit

| −40 | −30 | −20 | −10 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 100 |

| | −30 | | −20 | | −10 | | 0 | | 10 | | 20 | | 30 |
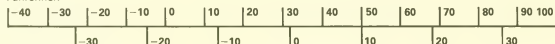
Celsius

To convert Fahrenheit to Celsius: subtract 32 then multiply by ⅝
To convert Celsius to Fahrenheit: multiply by ⅝ then add 32

---

### LIQUIDS

US gallons

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

| | 5 | | 10 | | 15 | | 20 | | 25 | | 30 | | 35 |
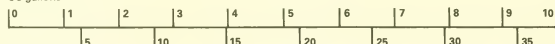
Liters

To convert gallons to liters: multiply by 3.7853
To convert liters to gallons: multiply by 0.2642

## Volume: liquid capacity

**1** US PINTS  UK PINTS  LITERS

**2**

| US pints | | UK pints | | US pints | | liters |
|---|---|---|---|---|---|---|
| 1.2010 | 1 | 0.8327 | | 2.1134 | 1 | 0.4732 |
| 2.4020 | 2 | 1.6653 | | 4.2269 | 2 | 0.9463 |
| 3.6030 | 3 | 2.4980 | | 6.3403 | 3 | 1.4195 |
| 4.8039 | 4 | 3.3306 | | 8.4537 | 4 | 1.8926 |
| 6.0049 | 5 | 4.1633 | | 10.567 | 5 | 2.3658 |
| 7.2059 | 6 | 4.9959 | | 12.681 | 6 | 2.8390 |
| 8.4069 | 7 | 5.8286 | | 14.794 | 7 | 3.3121 |
| 9.6079 | 8 | 6.6612 | | 16.907 | 8 | 3.7853 |

| US gallons | | UK gallons | | US gallons | | liters |
|---|---|---|---|---|---|---|
| 1.2009 | 1 | 0.8327 | | 0.2642 | 1 | 3.7853 |
| 2.4019 | 2 | 1.6653 | | 0.5284 | 2 | 7.5706 |
| 3.6029 | 3 | 2.4980 | | 0.7925 | 3 | 11.356 |
| 4.8038 | 4 | 3.3307 | | 1.0567 | 4 | 15.141 |
| 6.0047 | 5 | 4.1634 | | 1.3209 | 5 | 18.926 |
| 7.2057 | 6 | 4.9960 | | 1.5851 | 6 | 22.712 |
| 8.4066 | 7 | 5.8287 | | 1.8492 | 7 | 26.497 |
| 9.6076 | 8 | 6.6614 | | 2.1134 | 8 | 30.282 |
| 10.809 | 9 | 7.4941 | | 2.3776 | 9 | 34.067 |
| 18.014 | 15 | 12.490 | | 3.9627 | 15 | 56.780 |
| 30.024 | 25 | 20.817 | | 6.6045 | 25 | 94.633 |
| 42.033 | 35 | 29.144 | | 9.2463 | 35 | 132.49 |
| 54.043 | 45 | 37.470 | | 11.888 | 45 | 170.34 |
| 66.052 | 55 | 45.797 | | 14.530 | 55 | 208.25 |
| 78.062 | 65 | 54.124 | | 17.172 | 65 | 246.04 |
| 90.071 | 75 | 62.451 | | 19.813 | 75 | 283.90 |
| 102.08 | 85 | 70.777 | | 22.455 | 85 | 319.46 |
| 114.09 | 95 | 79.104 | | 25.097 | 95 | 359.60 |

| US fluid ounces | | UK fluid ounces | | US fluid ounces | | centi-liters |
|---|---|---|---|---|---|---|
| 0.9608 | 1 | 1.0408 | | 0.3381 | 1 | 2.9573 |
| 1.9216 | 2 | 2.0816 | | 0.6763 | 2 | 5.9145 |
| 2.8824 | 3 | 3.1224 | | 1.0144 | 3 | 8.8718 |
| 3.8431 | 4 | 4.1633 | | 1.3526 | 4 | 11.829 |
| 4.8039 | 5 | 5.2041 | | 1.6907 | 5 | 14.786 |
| 5.7647 | 6 | 6.2449 | | 2.0289 | 6 | 17.744 |
| 6.7255 | 7 | 7.2857 | | 2.3670 | 7 | 20.701 |
| 7.6863 | 8 | 8.3265 | | 2.7052 | 8 | 23.658 |
| 8.6471 | 9 | 9.3673 | | 3.0433 | 9 | 26.615 |

©DIAGRAM

a Bucket
b Pressure cooker
c Large saucepan
d Casserole
e Medium saucepan
f Mixing bowl
g Thermos (4-cup)
h Wine bottle
i Beer bottle
j Wine glass

1 Quick comparison of capacity units
2 Conversion tables: liquid capacity

## Measuring temperature

| C | F | r | K | R | C | F |
|---|---|---|---|---|---|---|
| 100 | 212 | 80 | 373.16 | | 100 | 212 |
| | 200 | | | 661.67 | 95 | 203 |
| 90 | 190 | 70 | 363.16 | 651.67 | 90 | 194 |
| | 180 | | | 641.67 | 85 | 185 |
| 80 | 170 | 60 | 353.16 | 631.67 | 80 | 176 |
| | | | | | 75 | 167 |
| 70 | 160 | | 343.16 | 621.67 | 70 | 158 |
| | 150 | | | 611.67 | 65 | 149 |
| 60 | 140 | 50 | 333.16 | 601.67 | 60 | 140 |
| | 130 | | | 591.67 | 55 | 131 |
| 50 | 120 | 40 | 323.16 | 581.67 | 50 | 122 |
| | 110 | | | 571.67 | 45 | 113 |
| | 100 | 30 | 313.16 | 561.67 | 40 | 104 |
| | 90 | | | 551.67 | 35 | 95 |
| 30 | 80 | 20 | 303.16 | 541.67 | 30 | 86 |
| | | | | 531.67 | 25 | 77 |
| 20 | 70 | | 293.16 | 521.67 | 20 | 68 |
| | 60 | 10 | | | 15 | 59 |
| 10 | 50 | | 283.16 | 511.67 | 10 | 50 |
| | 40 | | | 501.67 | 5 | 41 |
| 0 | 30 | 0 | 273.16 | 491.67 | 0 | 32 |
| −10 | 20 | | | 481.67 | −5 | 23 |
| | 10 | −10 | 263.16 | 471.67 | −10 | 14 |
| | 0 | | | 461.67 | −15 | 5 |
| −20 | −10 | −20 | 253.16 | 451.67 | −20 | −4 |
| | | | | 441.67 | −25 | −13 |
| −30 | −20 | | 243.16 | 431.67 | −30 | −22 |
| | −30 | | | | −35 | −31 |
| −40 | −40 | −30 | 233.16 | 421.67 | | |

C Centigrade (Celsius)
F Fahrenheit
r Réaumur
K Kelvin
R Rankine

©DIAGRAM

## Clothing sizes

| Category | USA | UK | Cont. |
|---|---|---|---|
| Ladies' hosiery | 8 | 8 | 0 |
| | 8½ | 8½ | 1 |
| | 9 | 9 | 2 |
| | 9½ | 9½ | 3 |
| | 10 | 10 | 4 |
| | 10½ | 10½ | 5 |
| Men's shoes | 8 | 7 | 41 |
| | 8½ | 7½ | 42 |
| | 9½ | 8½ | 43 |
| | 10½ | 9½ | 44 |
| | 11½ | 10½ | 45 |
| | 12 | 11 | 46 |
| Women's shoes | 6 | 4½ | 38 |
| | 6½ | 5 | 38 |
| | 7 | 5½ | 39 |
| | 7½ | 6 | 39 |
| | 8 | 6½ | 40 |
| | 8½ | 7 | 41 |

| Category | USA | UK | Cont. |
|---|---|---|---|
| Men's suits and overcoats | 36 | 36 | 46 |
| | 38 | 38 | 48 |
| | 40 | 40 | 50 |
| | 42 | 42 | 52 |
| | 44 | 44 | 54 |
| | 46 | 46 | 56 |
| Women's suits and dresses | 8 | 10 | 38 |
| | 10 | 12 | 40 |
| | 12 | 14 | 42 |
| | 14 | 16 | 44 |
| | 16 | 18 | 46 |
| | 18 | 20 | 48 |
| Men's shirts | 14 | 14 | 36 |
| | 14½ | 14½ | 37 |
| | 15 | 15 | 38 |
| | 15½ | 15½ | 39 |
| | 16 | 16 | 41 |
| | 16½ | 16½ | 42 |
| | 17 | 17 | 43 |

## Basic body measurements
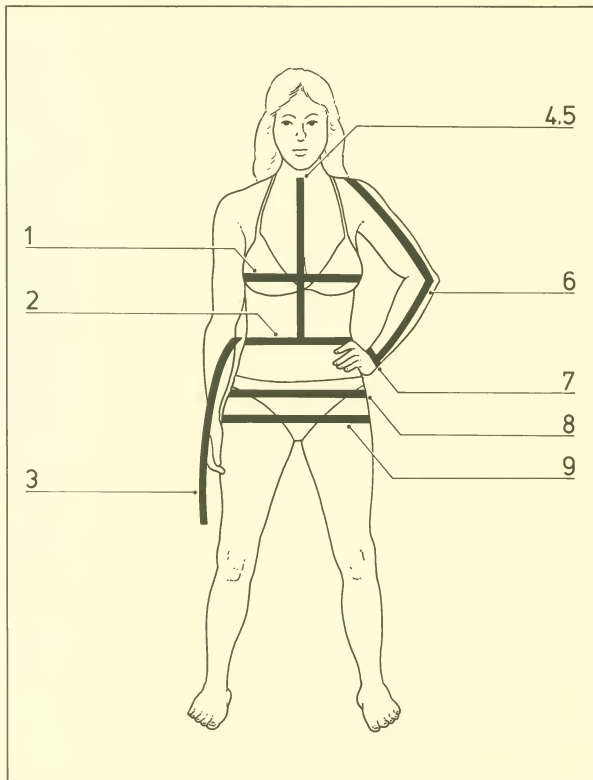
1 Bust (fullest part)
2 Waist
3 Skirtlength (waist to hem)
4 Center back (nape of neck to waist)
5 Center front (base of neck to waist)
6 Sleeve length (shoulder to wrist)
7 Wrist
8 Hips (7" below waist)
9 Hips (fullest part)

## Sewing stitches: 1
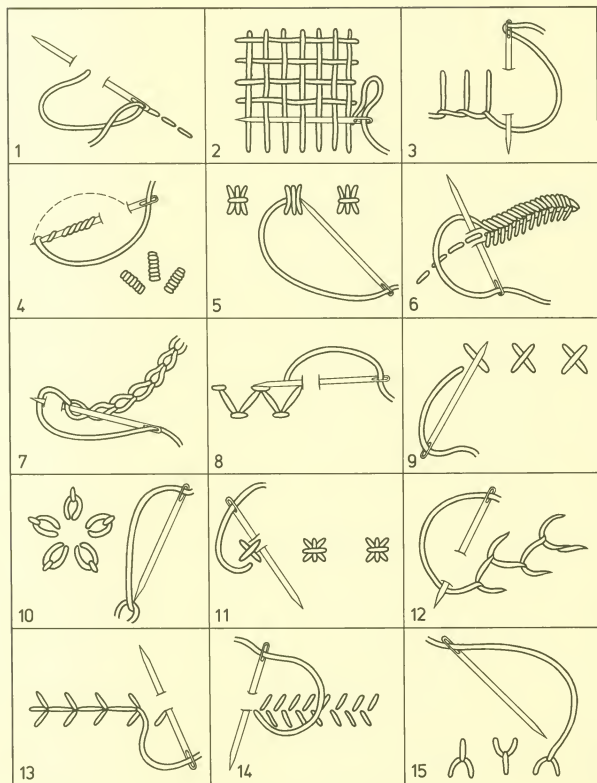
1 **Backstitch**
2 **Basket**
3 **Blanket**
4 **Bullion**
5 **Bundle**
6 **Buttonhole**
7 **Chain**
8 **Chevron**
9 **Cross**
10 **Daisy**
11 **Double cross**
12 **Feather**
13 **Fern**
14 **Fishbone**
15 **Fly**
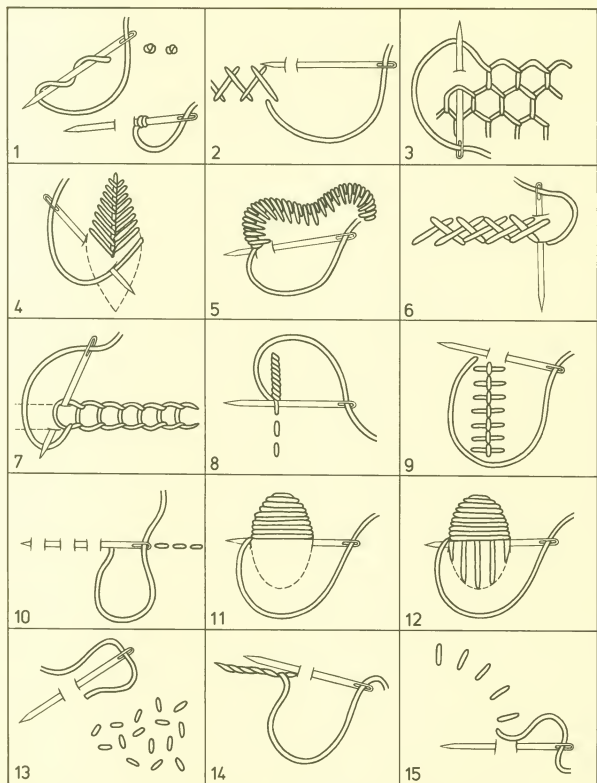
©DIAGRAM

## Sewing stitches: 2

1 French knot
2 Herringbone
3 Honeycomb
4 Leaf
5 Long and short
6 Long-armed cross
7 Open chain
8 Roll
9 Rumanian
10 Running
11 Satin
12 Satin dart
13 Seed
14 Stem
15 Straight

©DIAGRAM
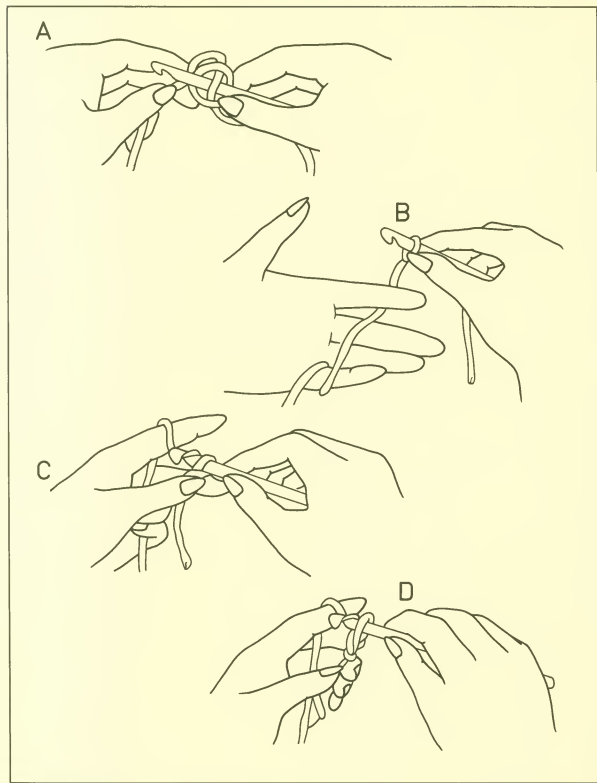
**Basic chain stitch (ch)**
**A** Make a loose slipknot round hook. Pull both ends of
yarn to tighten.
**B** Hold yarn tight round left hand.
**C** Catch yarn with hook and pull through to form a loop.
**D** Catch yarn again to form another loop.
Repeat until you have length of chain required.

## Crocheting: 2

1a

1b

2a

2b

3a

3b

4a

4b

5a

5b

©DIAGRAM
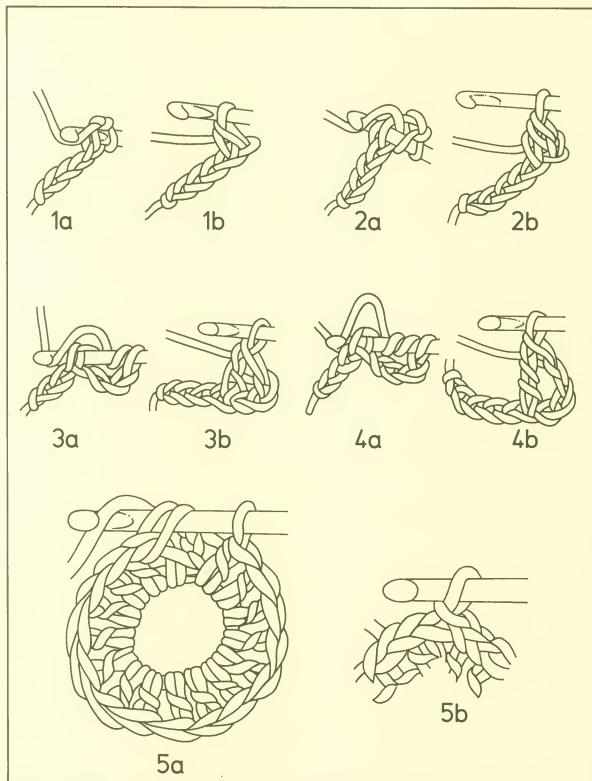
**Single crochet (sc)**
**1a** Insert hook in chain to left of loop. Catch yarn. Draw up to form second loop.
**1b** Pull yarn through both loops.
**Half-double crochet (hdc)**
**2a** Bring yarn forward. Insert hook in third chain.
**2b** Pull yarn through all three loops.
**Double crochet (dc)**
**3a** Bring yarn forward. Insert hook in fourth chain. Catch yarn to make loop. Three loops on hook. Pull yarn

forward. Draw yarn through two loops.
**3b** Pull yarn forward and draw through last two loops.
**Triple crochet (tr)**
**4a** Pull yarn over twice. Insert hook in fifth chain. Catch yarn to make loop. Four loops on hook. Pull yarn forward. Draw two loops. Yarn forward. Draw two more loops.
**4b** Pull yarn over and draw through last two loops.
**Slip stitch (sl st)**
**5a** Insert hook in stitch. Catch yarn to make loop.
**5b** Draw this loop through loop on hook.

**Knitting: 1**

©DIAGRAM
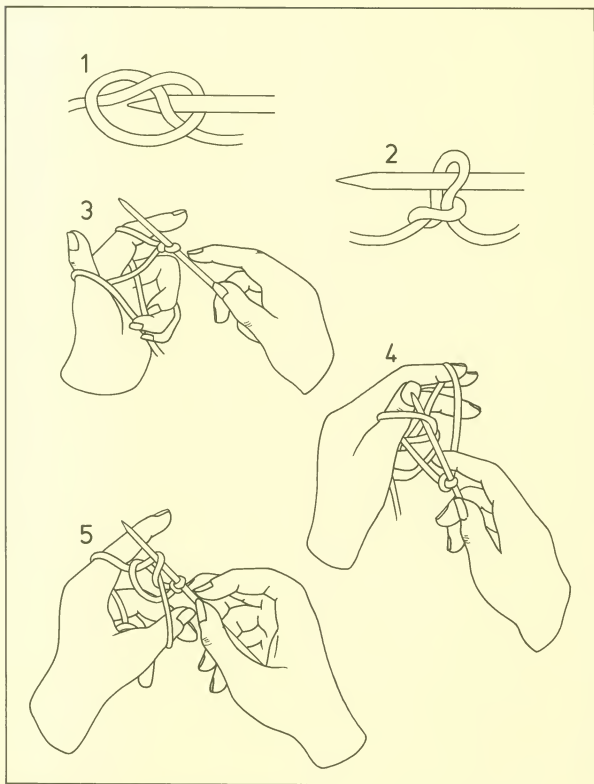
**Casting on**

1  Measure yarn, allowing 1″ for each stitch required, and make a slipknot.
2  Slide knot onto needle and tighten.
3  Wrap yarn from ball over left index finger and measured length on thumb.
4  Insert needle in loop on thumb.
5  Catch yarn on index finger, draw it through thumb loop with the needle and tighten by pulling end of thumb yarn.
Repeat 4 and 5 for required number of stitches.

**Knitting: 2**

1a

2a

1b

2b

1c

2c

3

4a

4b

©DIAGRAM
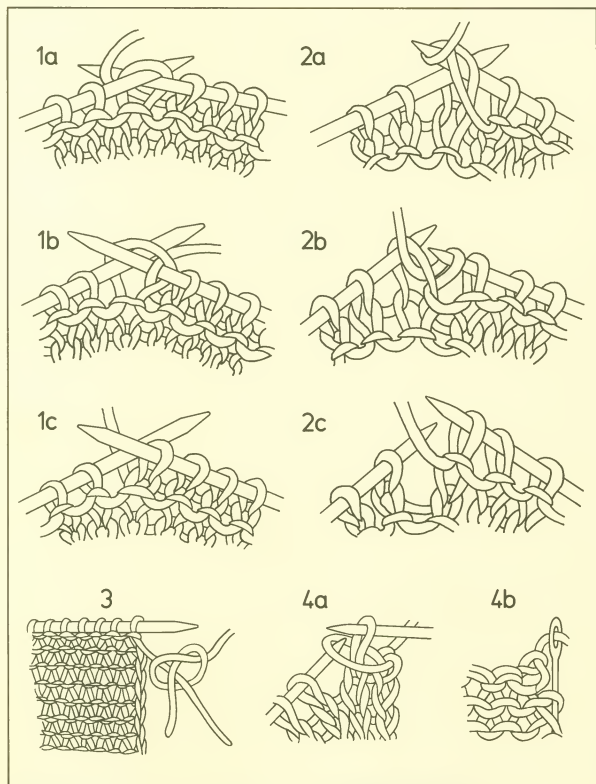
**1  Knit stitch**
**1a**  Hold row of stitches in left hand. Insert needle into stitch from front to back. Wrap yarn under and over needle.
**1b**  Pull loop through the stitch. Push old stitch off left needle.
**1c**  Keep new stitch on right needle and repeat until row finished.
**2  Purl stitch**
**2a**  Hold yarn in front and insert needle from back into stitch.
**2b**  Wrap yarn over and under needle and pull loop through stitch.

**2c**  Push stitch off left needle.
**3  Joining new ball**
Begin new ball of yarn at beginning of row. Tie end of yarn to new ball. Tighten knot. Ends can be woven in later.
**4  Casting off**
**4a**  Knit first two stitches on row, slip first stitch over second stitch and slip off needle. Knit the next stitch and slip previous one over it and off needle.
**4b**  Repeat until one stitch remains. Pull yarn through it and weave into side edge.

## Map of the hand
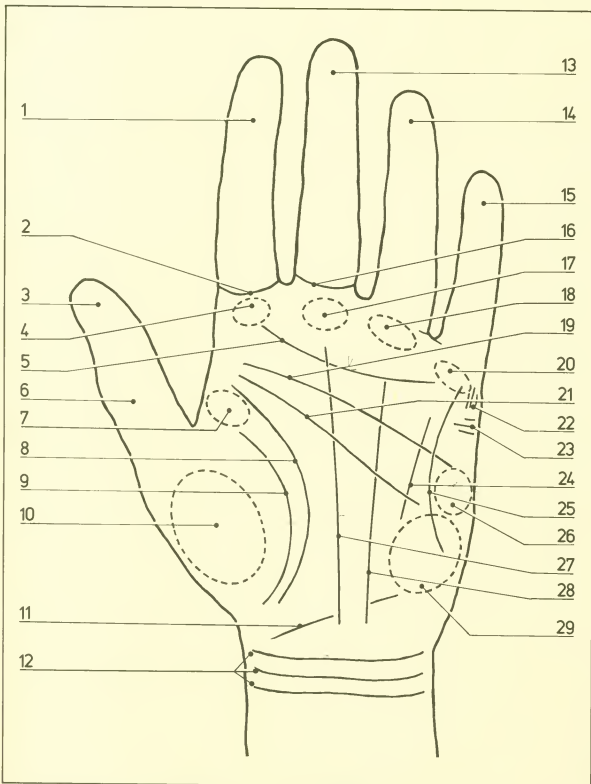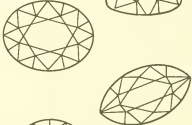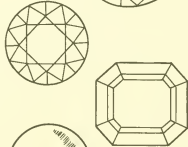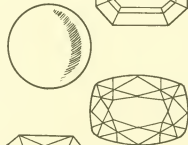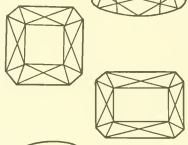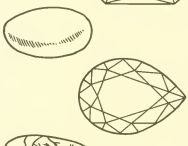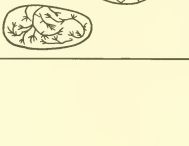
1 Finger of Jupiter
2 Solomon's ring
3 Phalange of will
4 Mount of Jupiter
5 Girdle of Venus
6 Phalange of logic
7 Lower mount of Mars
8 Lifeline
9 Line of Mars
10 Mount of Venus
11 Via Lasciva
12 Rascettes
13 Finger of Saturn
14 Finger of Apollo
15 Finger of Mercury
16 Ring of Saturn
17 Mount of Saturn
18 Mount of Apollo
19 Heartline
20 Mount of Mercury
21 Headline
22 Child lines
23 Line of marriage
24 Hepatica
25 Line of intuition
26 Upper mount of Mars
27 Line of fate
28 Line of the Sun
29 Mount of the Moon

©DIAGRAM

## Birthstones

| MONTH | ANCIENT | MODERN |
|-------|---------|--------|
| **January** | Garnet | Garnet |
| **February** | Amethyst | Amethyst |
| **March** | Jasper | Aquamarine or Bloodstone |
| **April** | Sapphire | Diamond |
| **May** | Agate | Emerald |
| **June** | Emerald | Pearl, Moonstone or Alexandrite |
| **July** | Onyx | Ruby |
| **August** | Carnelian | Peridot or Sardonyx |
| **September** | Chrysolite | Sapphire |
| **October** | Aquamarine | Opal or Tourmaline |
| **November** | Topaz | Topaz |
| **December** | Ruby | Turquoise or Zircon |

## Wedding anniversaries and gifts

| NUMBER | TRADITIONAL | MODERN |
| --- | --- | --- |
| 1st | Paper | Clocks |
| 2nd | Cotton | China |
| 3rd | Leather | Crystal and glass |
| 4th | Linen (silk) | Electrical appliances |
| 5th | Wood | Silverware |
| 6th | Iron | Wood |
| 7th | Wool (copper) | Desk sets |
| 8th | Bronze | Linens and lace |
| 9th | Pottery (china) | Leather |
| 10th | Tin (aluminum) | Diamond jewelry |
| 11th | Steel | Fashion jewelry, accessories |
| 12th | Silk | Pearls or colored gems |
| 13th | Lace | Textiles and furs |
| 14th | Ivory | Gold jewelry |
| 15th | Crystal | Watches |
| 20th | China | Platinum |
| 25th | Silver | Sterling silver jubilee |
| 30th | Pearl | Diamond |
| 35th | Coral (jade) | Jade |
| 40th | Ruby | Ruby |
| 45th | Sapphire | Sapphire |
| 50th | Gold | Gold |
| 55th | Emerald | Emerald |
| 60th | Diamond | Diamond |



©DIAGRAM
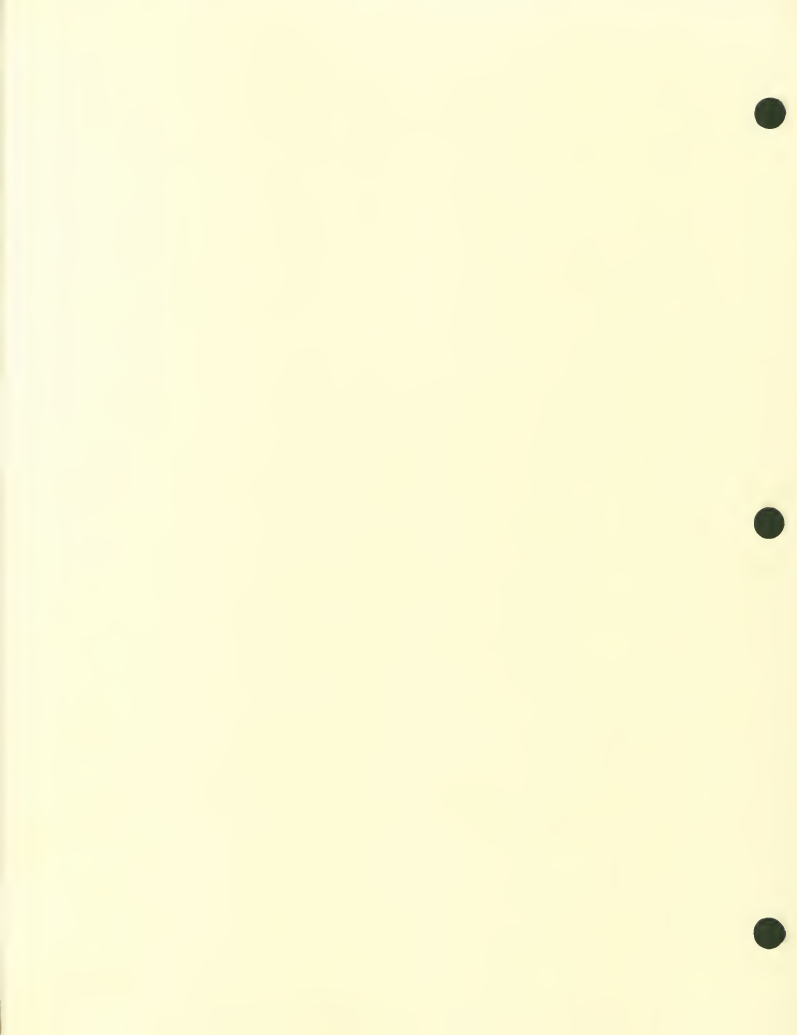
# INDEX

## A

**Acres,** conversion to hectares 4.026

**Aerials,** radio 2.016

**Africa,** size 1.017

**Air,** composition of 2.007; weight of 2.008

**Algae,** classification of 3.002; lowest depths found at 3.055

**Alphabet,** American manual 5.006; Braille 5.005; Greek 5.002; Hebrew 5.003; Russian 5.004

**Altitude,** and ecosystems 3.042

**Amino acids,** chart of 3.035

**Amphibians,** characteristics of 3.020; classification of 3.009, 3.013; evolution of 1.004, 3.048; highest levels found at 3.055; metamorphosis in 3.026; size of 3.051

**Angles,** names of 4.036

**Animals,** characteristics 3.018–3.020; circulatory system of 3.031; classification of 3.001; evolution of 1.002–1.005; excretion by 3.032; gestation periods of 3.053; highest and lowest levels found at 3.055; life processes of 3.021, 3.024–3.026; life spans of 3.054; regional distribution 3.039; reproduction of 3.022–3.023; respiratory system 3.030; sizes of 3.050–3.051; speeds of 3.056–3.057

**Anniversaries,** wedding 6.039

**Apes,** evolution of 1.006

**Architecture,** columns 5.023

**Area,** conversion table 4.026; of parts of a circle 4.035

**Arthropods,** characteristics 3.019; classification of 3.008; highest and lowest levels found at 3.055; numbers of 3.010; size of 3.051

**Asia,** size of 1.016

**Astrological symbols,** Chinese 4.008

**Astronomy,** symbols of 4.005

**Atmosphere,** composition and structure of 1.031

**Atmospheric pressure,** diagrams showing 2.008

**Atoms,** in polymers 2.027; structure of 2.003

## B

**Bacteria,** classification of 3.002

**Ballet positions** 5.017

**Beaufort Scale,** showing windspeeds 1.020

**Beds,** styles of 5.025

**Beef,** cuts of 6.016

**Bills,** passage through US parliament 5.046

**Birds,** characteristics of 3.020; classification of 3.009, 3.015; evolution of 1.002–1.005, 3.048; excretion by 3.032; gestation period of 3.053; highest and lowest levels found at 3.055

**Birthstones** 6.038

**Blood groups** 6.008–6.009

**Blood pressure,** by age 6.007

**Body,** human, measurements of 6.030; organs of 6.001–6.002

**Body temperature,** and pulse rate 6.006

**Boiling points,** of various substances 2.032

**Bottles,** wine 6.022

**Braille alphabet** 5.005

**Butterfly,** metamorphosis of 3.024

## C

**Calendar,** perpetual 4.010–4.017

**Calendars,** various 4.009

**Calories,** food values 3.036; human needs 3.037, 6.011

**Carbon,** forms of 2.028

**Carbon dioxide,** preparation of 2.028, 2.030

**Celestial objects,** positions of 2.041

**Celsius,** conversion to Fahrenheit 4.033, 6.026; conversion to Kelvin 4.033; temperature measurement 6.028

**Centiliters,** conversion to fluid ounces 4.030, 6.027

**Centimeters,** conversion to inches 4.025

**Chairs,** styles of 5.026

**Chemical substances,** formulae of 2.031

**Chicken,** cuts of 6.016

**Children,** growth of 6.004; immunization of 6.010

**Chinese astrological symbols** 4.008

**Chinese year dates** 4.008

**Chlorine,** preparation of 2.030

**Chordates,** classification of 3.009

**Circles,** degrees in 4.036; parts of 4.035

**Circuits,** electric 2.017–2.018

**Circulatory systems,** various 3.027, 3.031

**Cities,** mileages between 1.045–1.048; USA 1.043; World 1.044

**Climate,** by region 3.042

**Clothes,** men 5.019; sizes 6.029; women 5.018

**Clouds,** in a depression 1.029; types 1.030

**Coal,** uses of 2.026

**Columns,** architectural 5.023

**Compound interest,** tables 4.022

**Conductor,** orchestral 5.013

**Conifers,** classification of 3.005–3.006

## Constants,

**Constants,** physical 2.001

**Constellations,** of northern sky 2.042; of southern sky 2.043

**Continents,** divided into countries 1.015–1.018; evolution of 1.008; size of 1.009

**Constitution,** of USA 5.040

**Countries,** capitals of 5.049–5.058; currency of 5.049–5.058; languages of 5.049–5.058; largest 1.013; ranked by size 1.015–1.018; smallest 1.014

**Conversion tables,** area 4.026; length/distance 4.025, 6.026; liquid 4.030–4.032; speed 4.034; volume 4.027; weight 4.028–4.029

**Crocheting** 6.033–6.034

**Crystals,** structure of 2.004

**Cube roots,** value of 4.024

**Cubic centimeters,** conversion to cubic inches 4.027

**Cubic feet,** conversion to cubic meters 4.027

**Cubic inches,** conversion to cubic centimeters 4.027

**Cubic meters,** conversion to cubic feet 4.027

**Currents,** and magnetic fields 2.021

**Cycads,** classification of 3.005–3.006

## D

**Decibels,** and noise 2.015

**Decimals,** equivalents of fractions 4.021

**Department of State,** USA 5.044

**Degrees,** in angles 4.036

**Diamond,** structure of 2.028

**Digestive system,** in humans 3.027–3.028

**Dinner setting,** formal 6.025

**Diseases,** immunization against 6.010

**Distance,** conversion table 6.026

**Distances,** between cities 1.045–1.048

**Drilling,** oil 2.033–2.034

**Drugs,** effects of 6.015

## E

**Earth,** biogeographical regions of 3.039; evolution of 1.008; structure of 1.007; types of vegetation of 3.040

**Earthquakes,** causes of 1.024; scale of 1.025

**Echinoderms,** classification of 3.008; numbers of 3.010

**Eclipse,** of moon 2.048; of sun 2.047

**Ecosystems** 3.042

**Electricity,** transmission and distribution 2.037

**Electrostatics,** diagrams showing 2.020